VEHICLE ENGINEERING

VEHICLE ENGINEERING

	Presenter:
	Organization/Date: Orbiter/11-19-99

ORBITER	To Be Presented
SOFTWARE	To Be Presented
FCE	No Constraints
GFE	To Be Presented
FLIGHT READINESS STATEMENT	To Be Presented
BACKUP	

	Presenter:
	Organization/Date: Orbiter/11-19-99

STS-103
FLIGHT READINESS REVIEW

November 19, 1999

Orbiter

AGENDA

Presenter:

Organization/Date:
Orbiter/11-19-99

• Engineering Readiness Assessment	
• Previous Flight Anomalies	No Constraints
• Critical Process Changes	To Be Presented
• Engineering Requirement Changes	No Constraints
• Mission Kit Status	No Constraints
• Configuration Changes and Certification Status	To Be Presented
• Reliability Assessment	No Constraints
• Safety Assessment	No Constraints
• Special Topics	To Be Presented
• Fleet Wire Inspection & Repair Status	
• Nose Landing Gear Lockbrace Bungee Bellcrank Assembly	
• Panel C3 Main Engine Shutdown Switch Decal Issue	
• RCS Manifold 5 Oxidizer Isolation Valve	
• MPS GO_2 ET/Orbiter 2 Inch Disconnect	
• Flight Readiness Statement	To Be Presented
• Backup Information	

	Presenter:
	Organization/Date: Orbiter/11-19-99

CRITICAL PROCESS CHANGES

STS-103 CRITICAL PROCESS CHANGE REVIEW SUMMARY

Presenter: Doug White

Organization/Date: Orbiter/11-19-99

Item Reviewed	No. of Items Reviewed	Period or Effectivity Covered	No. Found To Be Critical Process Changes
OMRSD Changes (RCNs)	21	STS-103 Specific & Non-Flight Specific Changes Approved 5/29/99 - 10/15/99	0
OMRSD Waivers & Exceptions	7	STS-103 Specific	0
IDMRD Changes (MCNs)	54	Approved 5/29/99 - 10/15/99	1
IDMRD Waivers & Exceptions	4	Approved 5/29/99 - 10/15/99	0
EDCPs	25	Closed 5/29/99 - 10/15/99	4
BNA Specifications	76	Released 5/29/99 - 10/15/99	1
BNA Drawings	593	Released 5/29/99 - 10/15/99	0
Material Review	348	Approved 5/29/99 - 10/15/99	1

- All process changes were reviewed and none constrain STS-103

CRITICAL PROCESS CHANGES

Presenter:
Juliet Davis
Organization/Date:
Orbiter/11-19-99

MCN OM2844M2, OMS Tank Repair Certification for WSTF

- Authorizes the repair requirements for OMS Propellant Tank certification at WSTF
- Full-up repair demonstration was performed using WSTF assembly and test (ATP) procedures

CRITICAL PROCESS CHANGES

Presenter: Doug White

Organization/Date: Orbiter/11-19-99

EDCP 1-0081, ATP Revision for Radiator Panel Leak Test:

- This EDCP revised the radiator panel ATP to replace vacuum chamber Freon leak detection test with pressure decay test using nitrogen
- Change was made to eliminate need for now obsolete GSE at the vendor (LMVS)

EDCP 1-0085, Radiator Panel Doubler Material Callout Correction and Cleaning Note Addition:

- This EDCP corrected an erroneous material heat treat designation on vendor drawing and added cleaning notes for radiator panel strip doublers

CRITICAL PROCESS CHANGES

Presenter: Doug White

Organization/Date: Orbiter/11-19-99

EDCP 1-0087, Radiator Panel Cleaning Process Spec Addition and Associated ATP Revision

- This EDCP approved a new cleaning process specification (LMVS) silver-Teflon radiator and a revision to the radiator ATP to specify coverlay removal and cleaning per the new specification. The LMVS spec requires initial cleaning after refurbishment using Bioact 105 cleaner to remove residual Latex adhesive from the surface of the radiators

EDCP 2703-115-EW, Negative Pressure Relief Valve ATP Change

- This EDCP revised the negative pressure relief valve ATP to include use of computerized data gathering equipment and associated additional pressure transducers and flowmeters (valve is a component of ARS pressure control system)
- The EDCP also increased the regulated nitrogen supply for the poppet cracking and reseat pressure test to assure the proper flow rate is reached through the valve

CRITICAL PROCESS CHANGES

Presenter: Doug White

Organization/Date: Orbiter/11-19-99

Boeing Specification MT0501-514 Rev E, Requirements for Inspection of Orbiter Windows:

- Spec revision incorporated mold impression measurement groundrules to include not taking mold impressions for defects less than 0.002" deep for windows #2 & #5 and less than 0.009" deep for windows #3 and #4
- Stress analysis confirmed defects within 0.003" for window #2 & #5, and 0.010" for window #3 & #4 are acceptable for restricted use (same position only, no flipping) even in highest load region of the glass (center)

Material Review Disposition:

- Approved to increase cure temperature of aluminum thermal coating paint (TT-P-28 cured at 400°F) for payload bay longeron bridges
- Long term solution will be to create process specification, MA0108-361, and new paint specification, MB0125-098 to precisely control overall paint process. Drawing changes will be made to provide direct drawing callouts of these specifications for complete configuration control of their use

	Presenter:
	Organization/Date: Orbiter/11-19-99

CONFIGURATION CHANGES

CONFIGURATION CHANGES AND CERTIFICATION STATUS

Presenter: Doug White

Organization/Date: Orbiter/11-19-99

16 Modifications Were Incorporated During The STS-103 Processing Flow:

- Nine are flying for the first time
  - MCR 19030 Airlock venting mod [Discussion Item]
  - MCR 19331 Tunnel adapter lighting wiring - backout
  - MCR 19398 Space-To-Space Orbiter Radio (SSOR) - backout
  - MCR 19362 Drag chute mortar box upgrade
  - MCR 19392 BHS and body flap acoustic cap
  - MCR 19268 External airlock canopy - partial
  - MCR 11621 AC bus wire harness separation
  - MCR 11621 TSA fitting and blanket mod
  - MCR 18883 Advanced air data transducer [Discussion Item]
  - MCR 19156 Lightweight lockers [Discussion Item]

All Required Certification Documentation Have Been Submitted and Are Approved

FIRST FLIGHT OF ADVANCED AIR DATA TRANSDUCER

Presenter: Doug White

Organization/Date: Orbiter/11-19-99

New AADT Is One of Four Air Data Transducers on STS-103 and Is Installed in Slot 1

- Slot chosen because of the availability of high down list data rate

New AADT Requires Less Frequent Calibration, Reducing Maintenance Costs

New AADT Solves the Old ADTA EEE Parts Obsolescence Problem

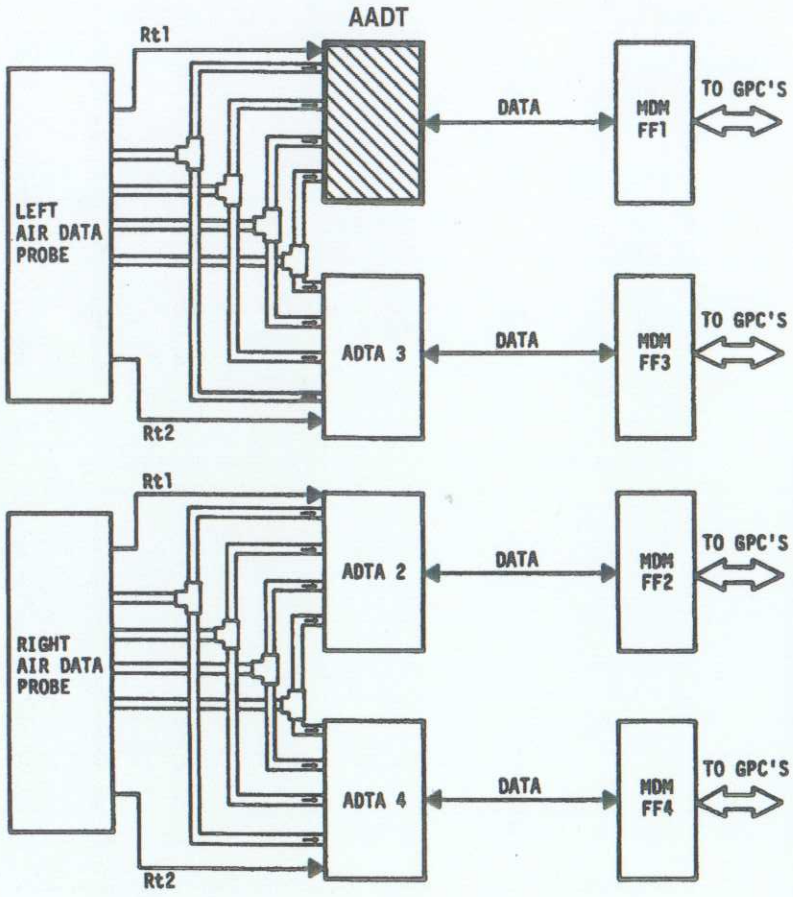
The AADT Will Be Deployed Incrementally in the Fleet Over the Next Three Flights

- One AADT on STS-099, 01/13/00 (OV-105, Flight 14)
- One AADT on STS-101, 03/16/00 (OV-104, Flight 21)
- Four AADTs on STS-092, 06/14/00 (OV-103, Flight 28)

DEPLOYMENT OF ADVANCED AIR DATA TRANSDUCER

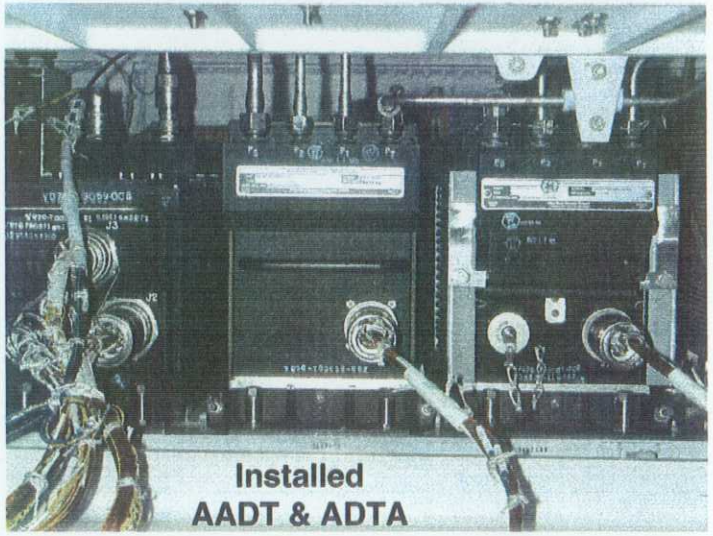
Presenter:
Doug White

Organization/Date:
Orbiter/11-19-99



Air Data System Block Diagram

Advanced Air Data Transducer



Installed AADT & ADTA

DEPLOYMENT OF ADVANCED AIR DATA TRANSDUCER

Presenter: Doug White

Organization/Date: Orbiter/11-19-99

New AADT Is Mechanically, Electrically, and Functionally Transparent to the Orbiter With a Few Exceptions

- New AADT employs radiant cooling; eliminating the forced air cooling required by the ADTA
- New AADT status word contains additional status bits
- External annunciation temperature circuit good status bit has been eliminated
  - Total temperature data not currently used by GPCs

DEPLOYMENT OF ADVANCED AIR DATA TRANSDUCER

Presenter: Doug White

Organization/Date: Orbiter/11-19-99

AADT Has Been Fully Qualified for Orbiter Service According to Orbiter Specifications for Avionics Hardware

- Proton radiation testing, 9/97
- Qualification testing, 11/98 -2/99
- SAIL testing, 1/99
- NASA signed certification on September 3, 1999

Launch Commit Criteria (LCC) Change to Accommodate AADT in Orbiter ADTA Slot 1 Pending Approval

- LCN No. 920R04 has been submitted to change LCC for flight of single AADT in ADTA slot 1
- Further LCC change will be required to fly four AADTs on an Orbiter

FIRST FLIGHT OF LIGHTWEIGHT MIDDECK STOWAGE LOCKERS

Presenter:
Doug White
Organization/Date:
Orbiter/11-19-99

Light Weight Middeck Stowage Lockers Are One of Several Forward Fuselage & Cargo Bay Weight Saver Items to Fly Over the Last Few OV-103 Flights

Other Weight Saver Items	First Flight
• LW Tool Stowage Assemblies	STS-96
• LW Middeck Accommodations Rack	STS-96
• LW Pallets	STS-96
• LW Trays	STS-95
• LiOH Bags	STS-95

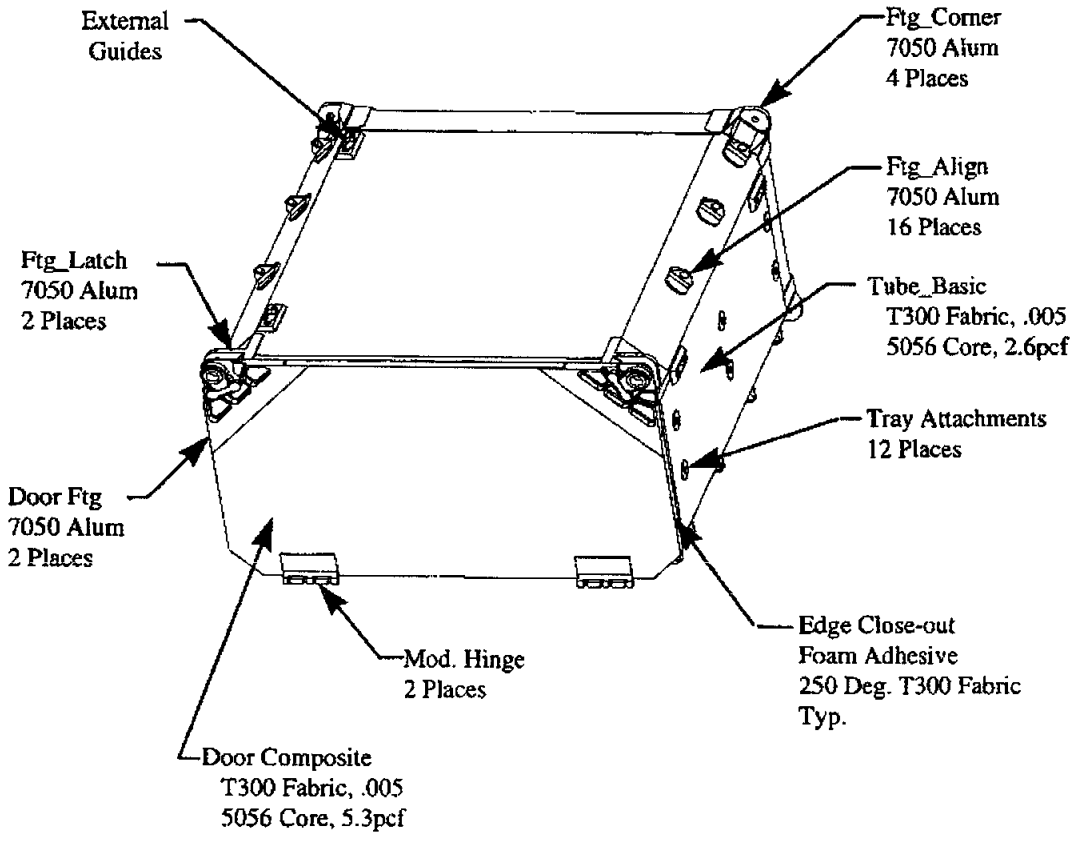
3 Ship Sets of LW Lockers Will Be Manufactured (132 Total Units)

- First ship set of 41 LW lockers delivered in August 1999
  - 20 LW lockers will be installed in fwd middeck for STS-103 flight
- 2nd/3rd ship sets in production - complete Jan/Mar, 2000

FIRST FLIGHT OF LIGHTWEIGHT MIDDECK STOWAGE LOCKERS

Presenter:
Doug White
Organization/Date:
Orbiter/11-19-99

LW Locker Weight Savings ~ 5 lb Per Locker/200 lb Per Ship Set



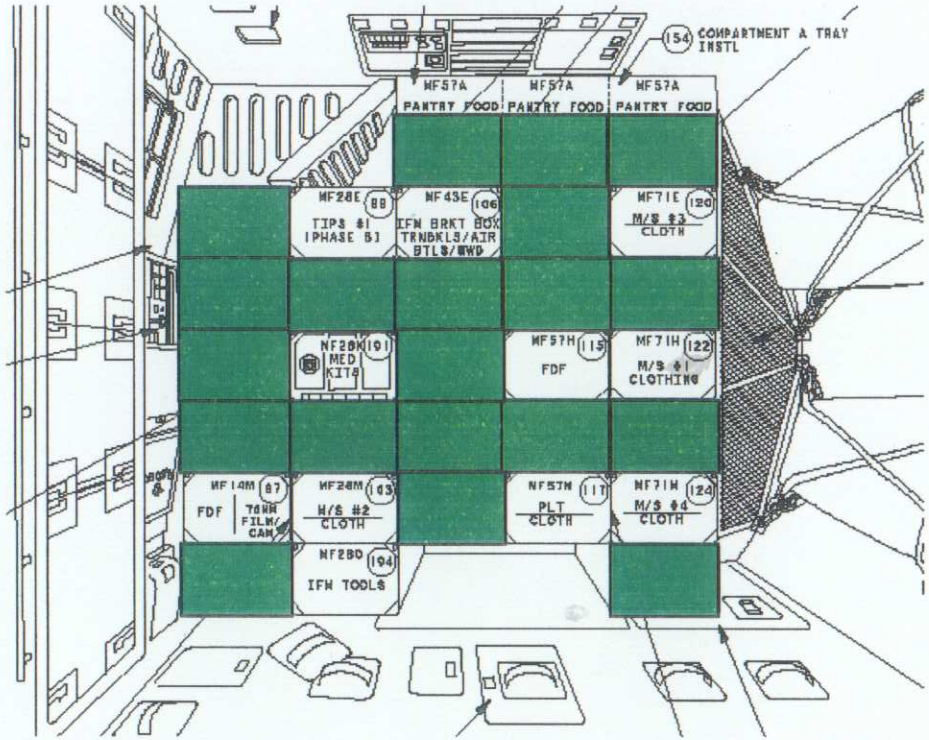
Light Weight Locker

FIRST FLIGHT OF LIGHTWEIGHT MIDDECK STOWAGE LOCKERS

Presenter:
Doug White

Organization/Date:
Orbiter/11-19-99

20 LW Lockers In Forward Middeck



FIRST FLIGHT OF LIGHTWEIGHT MIDDECK STOWAGE LOCKERS

Presenter:
Doug White
Organization/Date:
Orbiter/11-19-99

Light Weight Locker Design Certification Approved July 1999

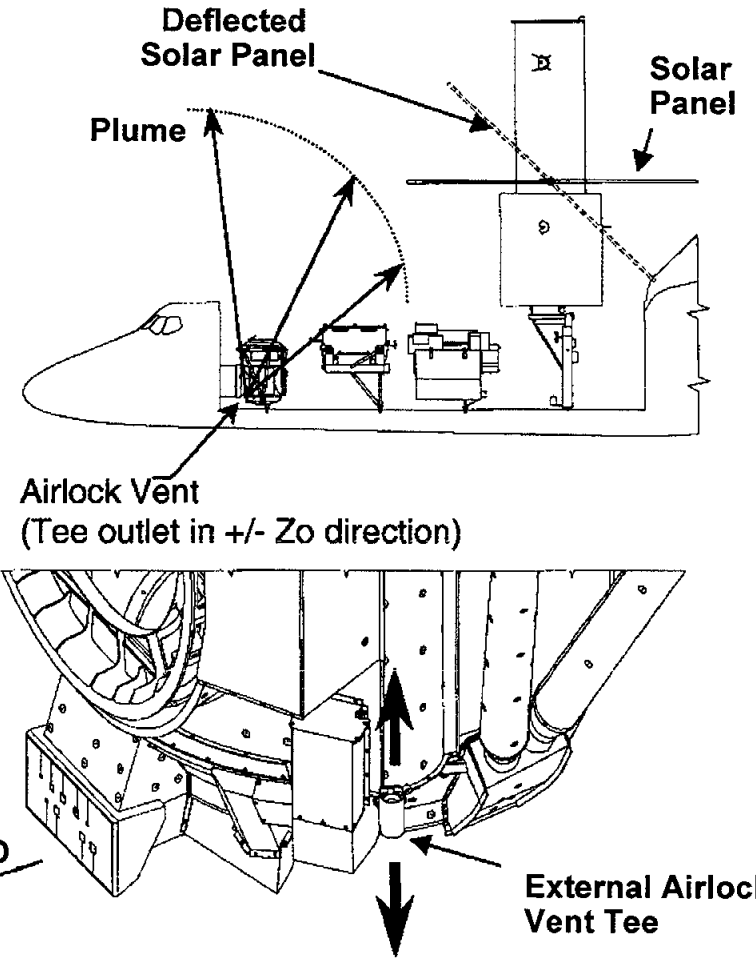
- Certified by test, analysis, & similarity
  - Qual test identified Milson defect (CAR) - redesign in work
- Included certification deviation for 20g crash load (Milsons)
- OVEI waiver submitted for 20g crash loads (Milsons)

EXTERNAL AIRLOCK VENTING SYSTEM MODIFICATION TO PROTECT HST SOLAR ARRAYS

Presenter: Doug White
Organization/Date: Orbiter/11-19-99

ODS Venting During STS-82 (HST-SM2) First EVA Airlock Depress Caused Unexpected Movement of the HST -Yo Solar Array

- Documented in payload IFA No. STS-82-PLD-01
- Used position 0 (full open) of the depress valve

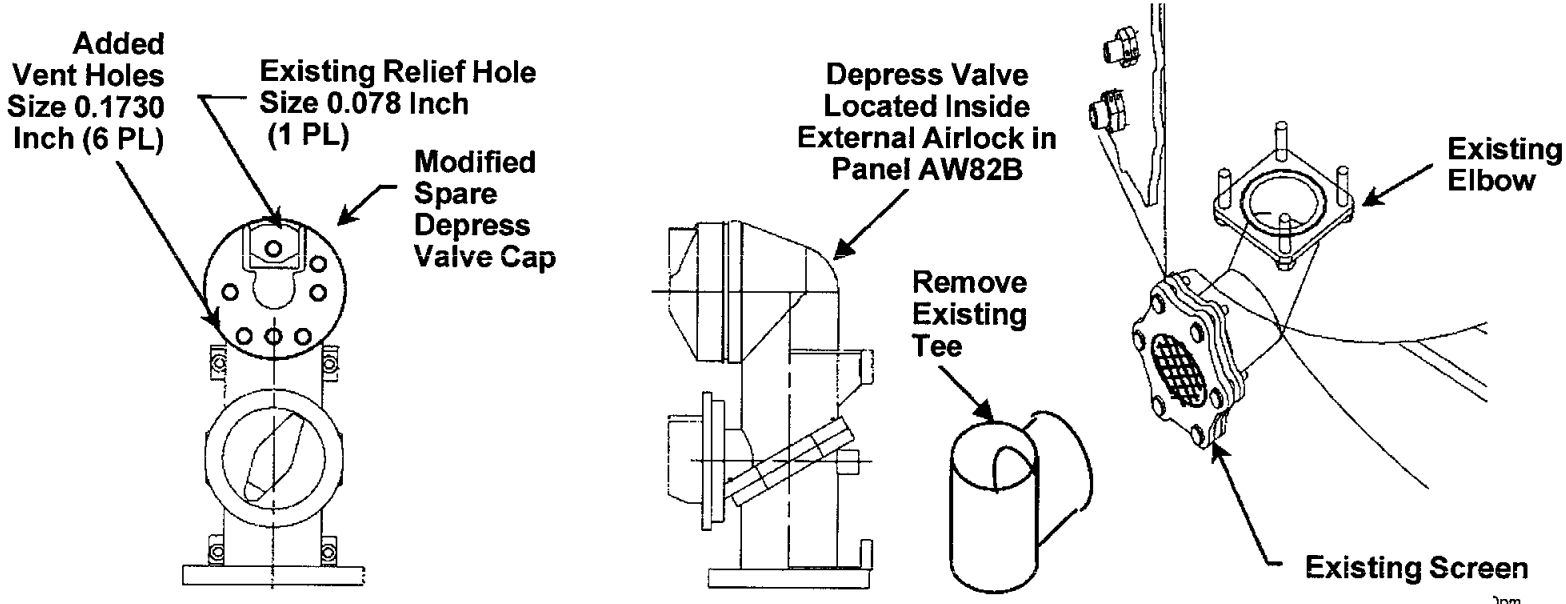


EXTERNAL AIRLOCK VENTING SYSTEM MODIFICATION TO PROTECT HST SOLAR ARRAYS

Presenter:
Doug White
Organization/Date:
Orbiter/11-19-99

VECB (5-19-99) Approved Modification of the Depress Valve Inlet Cap With Small Holes to Reduce the Flow Rate and Approved Removal of the Vent Tee Outlet to Re-Direct the Flow for STS-103 (ref. MCR 19030)

- 2 Modified caps were completed on 8-06-99, and removal of tee outlet was completed on 8-20-99
- Holes drilled in cap sized by analysis



EXTERNAL AIRLOCK VENTING SYSTEM MODIFICATION TO PROTECT HST SOLAR ARRAYS

Presenter: Doug White
Organization/Date: Orbiter/11-19-99

External Airlock Venting Modification Certified for Flight by Test

- Verification analysis conducted jointly by JSC and Boeing using the Engineering Test Article (ETA)
- Caps tested in conjunction with crew training
  - Similar configuration as flight system
  - Caps (two) were tested in numerous configurations
    - Depress valve in 0 and 5 positions
    - Different number of holes in cap taped
- Taping one hole and placing depress valve in the 0 position meets requirements
  - HST requirement of 100 lbs/hr maximum met
  - Planned flow meets MOD 20 minute EVA depress time requirement

EXTERNAL AIRLOCK VENTING SYSTEM MODIFICATION TO PROTECT HST SOLAR ARRAYS

Presenter:
Doug White

Organization/Date:
Orbiter/11-19-99

STS-103 Crew Trained With Modified Depress Valve Caps

- Caps (2) stowed in locker for STS-103 to be used for airlock venting

Crew Procedures in Place to Protect HST During External Airlock Venting

	Presenter:
	Organization/Date: Orbiter/11-19-99

SPECIAL TOPICS

SPECIAL TOPICS FOR THE STS-103 FLIGHT READINESS REVIEW	Presenter:
	Organization/Date: Orbiter/11-19-99

Topic	Presenter
Fleet wire inspection & repair status	Doug White
Nose landing gear lockbrace bungee bellcrank assembly	Doug White
Panel C3 main engine shutdown switch decal issue	Doug White
RCS manifold 5 oxidizer isolation valve	Brian Werner
MPS GO_2 ET/Orbiter 2 inch disconnect	Tim Reith

FLEET WIRE INSPECTION & REPAIR SUMMARY

Presenter:
Doug White
Organization/Date:
Orbiter/11-19-99

Observation:

- STS-93 AC1 short was isolated to a mechanically induced exposed conductor located above a rough screw head in the lower port midbody wire tray between bays 11 and 12
  - The exposed conductor had shorted to the screw head
- During the initial inspections of OV-102 and OV-104, additional wire damage was found

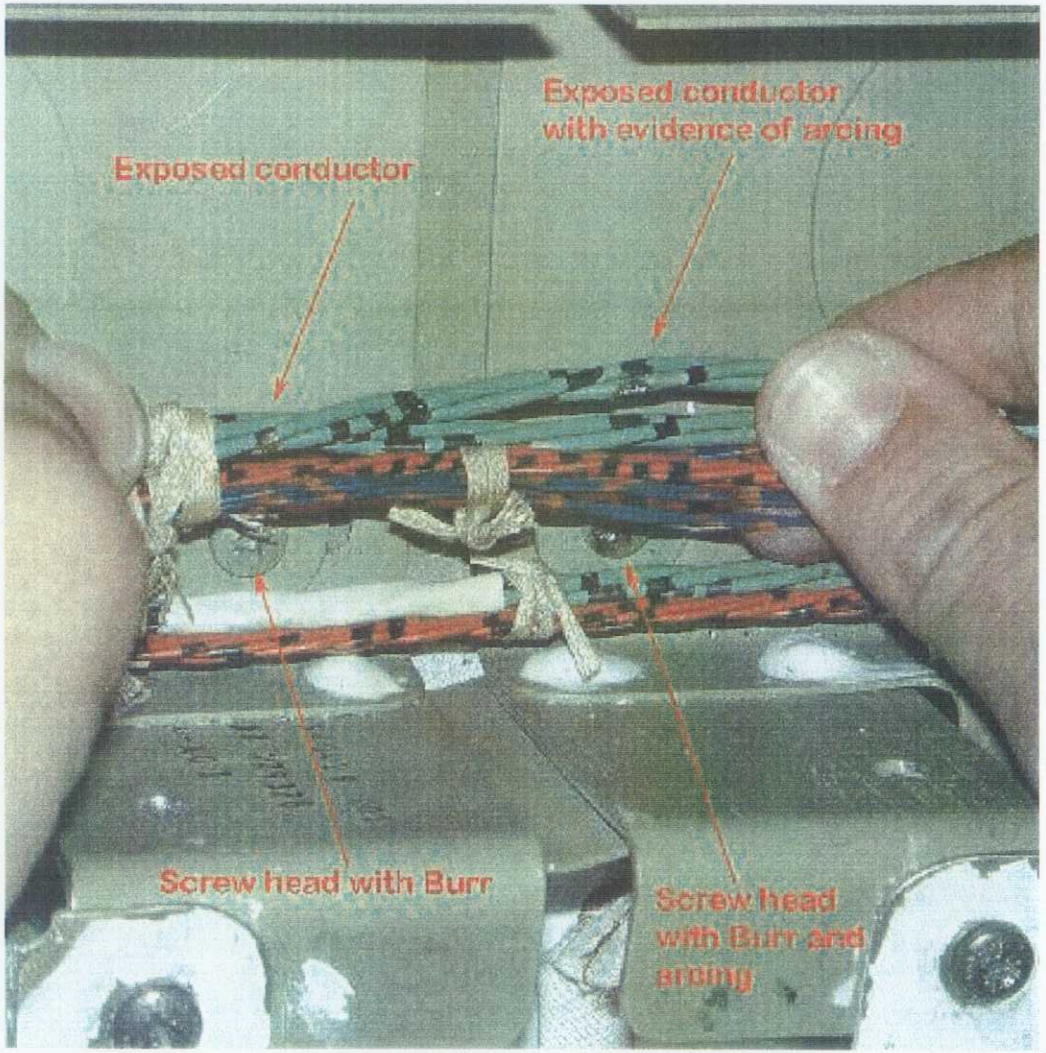
Concern:

- Other undetected exposed conductors could exist, and additional shorts may occur

FLEET WIRE INSPECTION & REPAIR SUMMARY

Presenter:
Doug White

Organization/Date:
Orbiter/11-19-99



FLEET WIRE INSPECTION & REPAIR SUMMARY

Presenter: Doug White

Organization/Date: Orbiter/11-19-99

Risk Assessment Actions Taken:

- Developed logical inspection criteria based on:
  - High traffic areas
  - Significant modification areas
  - PRACA
  - Redundancy routing and crit 1/1 circuits
- OV-103 inspected and repaired in OPF
  - Vehicle inspected per logic criteria
  - Damaged wire repaired
  - Added wire protection as required per spec plus additional protection in the midbody wire trays
- OV-103 retest conducted in OPF and at pad
  - Most functions will be checked before the start of launch countdown
    - Some functions such as heaters require invasive procedures to verify and will not be exercised

FLEET WIRE INSPECTION & REPAIR SUMMARY

Presenter:
Doug White
Organization/Date:
Orbiter/11-19-99

New Observation

- During OV-105's monoball inspection, damage was noted on the heat shrink protective insulation
  - The heat shrink was removed and the wires were inspected for damage
  - Radial cracking (exposed conductor) was found

Concern

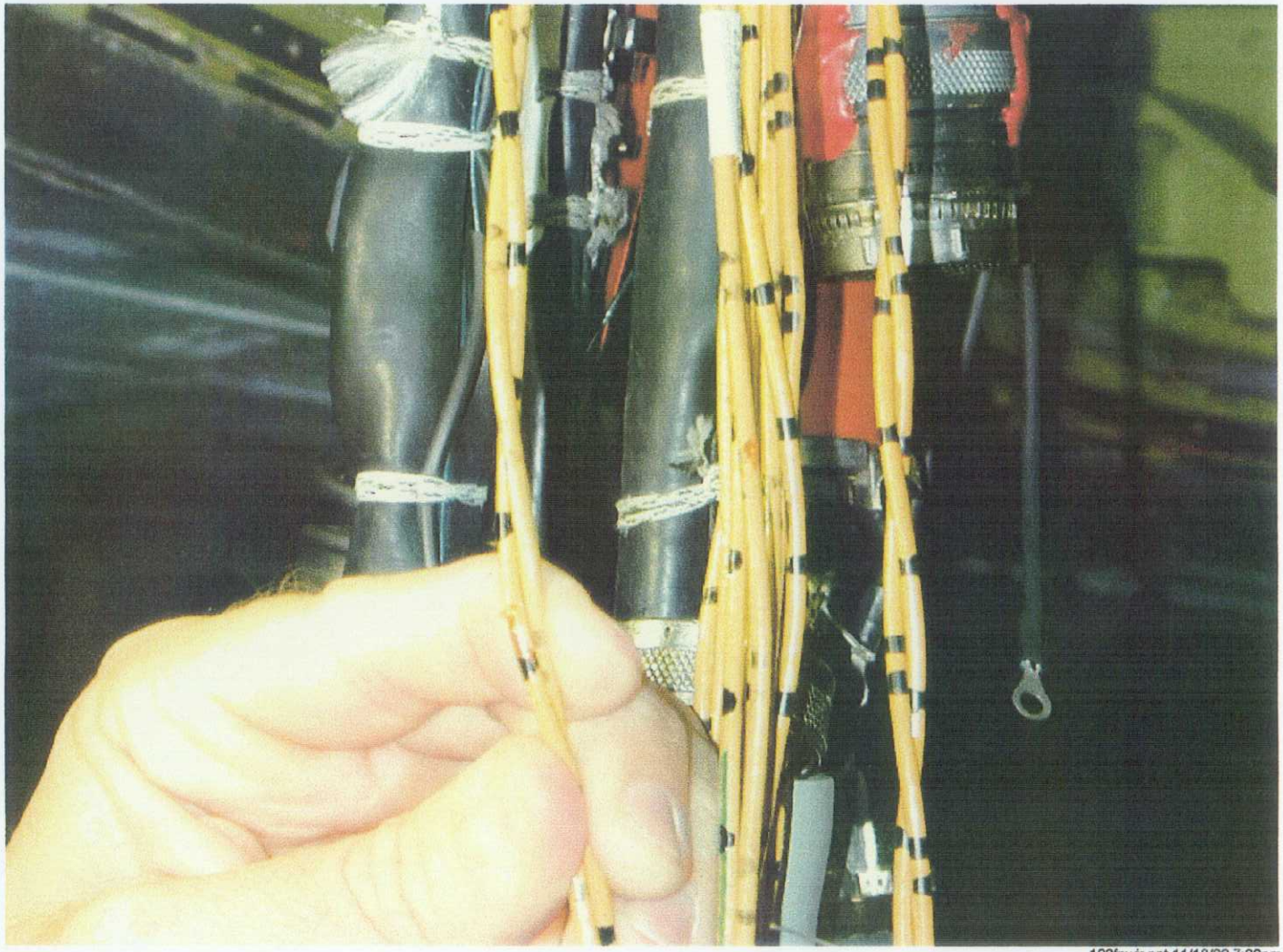
- Per our inspection logic criteria, another aspect of the work-induced damage root cause was identified
  - Potential for undetected exposed conductor in harnesses which may have had minor pre-existing Kapton damage before installation of wire protection and which are subject to frequent flexing

FLEET WIRE INSPECTION & REPAIR SUMMARY

Presenter:
Doug White
Organization/Date:
Orbiter/11-19-99

FLEET WIRE INSPECTION & REPAIR SUMMARY

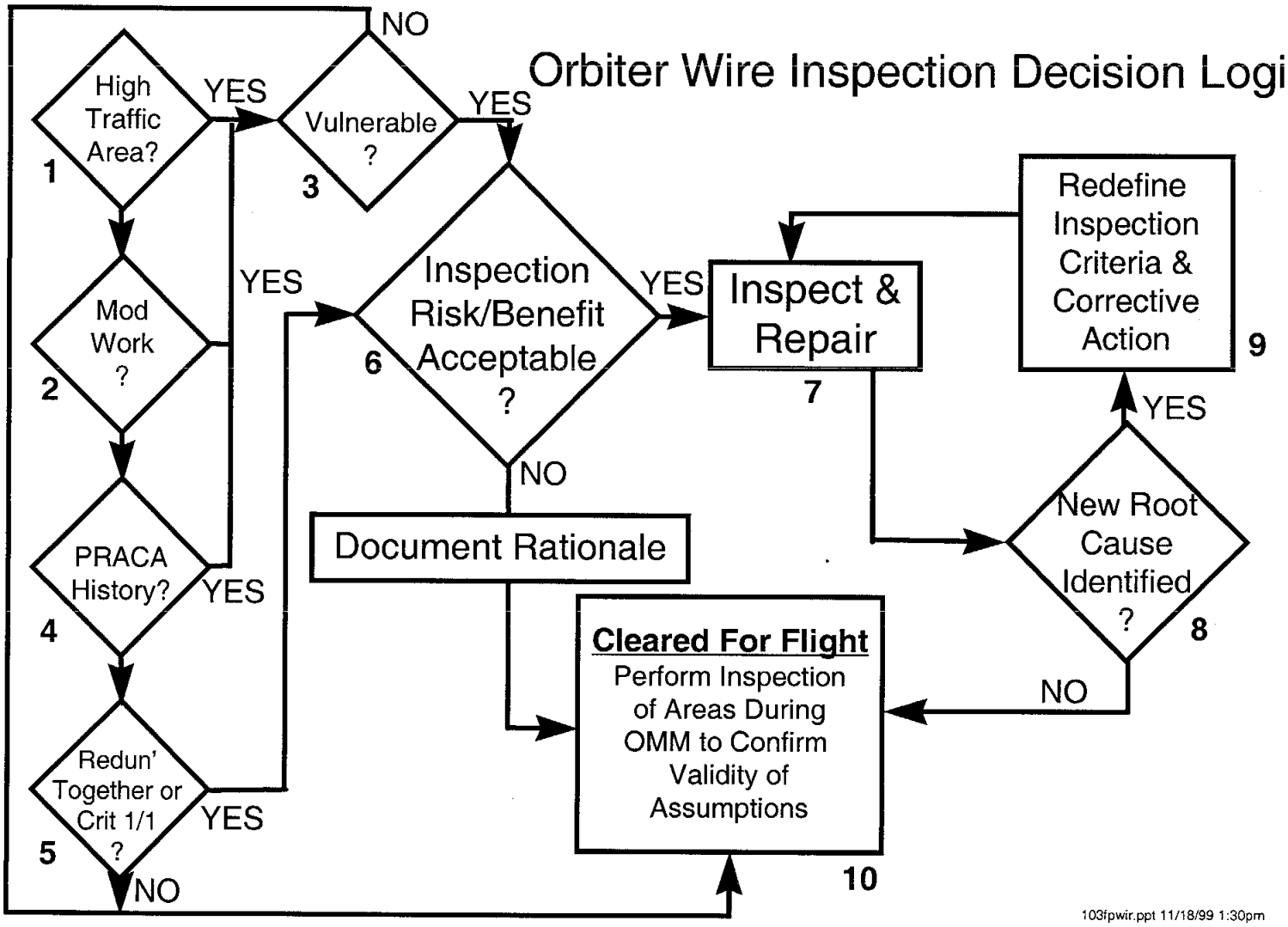
Presenter:
Doug White
Organization/Date:
Orbiter/11-19-99



FLEET WIRE INSPECTION & REPAIR SUMMARY

Presenter:
Doug White
Organization/Date:
Orbiter/11-19-99

Orbiter Wire Inspection Decision Logic



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FLEET WIRE INSPECTION & REPAIR SUMMARY

Presenter:
Doug White
Organization/Date:
Orbiter/11-19-99

Discussion:

- The monoball wire harnesses and connectors are in an area of the aft that require them to be moved for access
- The monoball harnesses were not part of the original detailed wire inspections
  - This area is covered by heat shrink material and was considered protected from the root cause of the wire damage - physical contact
  - Although they were inspected before being protected with sleeving, minor Kapton damage allowed at the time, combined with repeated wire flexing, led to ring cracks
- Per our logic criteria, we re-defined our inspection criteria to evaluate areas of frequent wire flexing
  - Most Orbiter harnesses are not routinely flexed

FLEET WIRE INSPECTION & REPAIR SUMMARY

Presenter:
Doug White
Organization/Date:
Orbiter/11-19-99

Discussion:

- OV-103 monoball cables are suspect and will be inspected
  - Remove the heat shrink insulation and do an inspection of all the wires in the harnesses (15 Total)
- All engine interface cables are suspect and will be inspected
  - Remove convoluted tubing and do an inspection of all the wires in the harness
- Any damaged wire will be repaired
- Shuttle Integrated Test (S0008) will be performed for retest

FLEET WIRE INSPECTION & REPAIR SUMMARY

Presenter:
Doug White
Organization/Date:
Orbiter/11-19-99

Discussion:

- All other areas where wire bundles are routinely flexed during processing or flight have been assessed
  - KU deployed assembly
    - Flexed with each KU-DA deploy and stow
    - Range of motion is limited (twist)
    - Cables are manufactured with PTFE over-wrap
  - Aft ET sep pyros
    - Cables are demated/remated each flow
    - Cables were redesigned to eliminate a pinch point
    - Hi-pot tested every third flow and replaced at OMDP
    - Covered with convoluted tubing at installation
  - Fwd ET sep
    - Cables are removed, inspected, and Hi-pot tested each flow

FLEET WIRE INSPECTION & REPAIR SUMMARY

Presenter:
Doug White
Organization/Date:
Orbiter/11-19-99

Discussion:

- All other areas where wire bundles are routinely flexed during processing or flight have been assessed
- NLG and MLG wire harness protection part of original design
  - MPMs and payload bay door crossovers
    - Wires are visible
    - Inspected as part of the overall wire inspections
  - Payload retention latches
    - Flexed when latches are repositioned
    - Wires are manufactured with Teflon over-braid
    - AC power to latches will not be energized this flight
  - Payload patch panel, A7, aft flight deck
    - Flexed when configured for each mission
    - Cables are manufactured with Teflon over-braid

FLEET WIRE INSPECTION & REPAIR SUMMARY

Presenter:
Doug White
Organization/Date:
Orbiter/11-19-99

Discussion:

- All other areas where wire bundles are routinely flexed during processing or flight have been assessed
  - TIPS downlink cable
    - Flexed during ground processing and by the crew during flight
    - Teflon insulation
      - Good flexibility; low potential to ring crack
    - New cable for this flight
  - Seats
    - Seats repositioned during ground processing and by the crew
    - Generous bend radii accommodate flexing
    - Inspection of visible wiring was done and wire protection added as part of the overall inspections

FLEET WIRE INSPECTION & REPAIR SUMMARY

Presenter:
Doug White
Organization/Date:
Orbiter/11-19-99

Discussion:

- All other areas where wire bundles are routinely flexed during processing or flight have been assessed
  - Keel camera and payload bay cameras
    - Flexed during camera mating and pan/tilt operations
    - Tefzel insulation
      - Fair flexibility; low potential to ring crack
  - Fire extinguisher, KU jettison and landing gear pyro cables
    - Interrupt boxes are installed to eliminate cable flex for multiple simulator installations
    - Cables from FLCAs to interrupt box have shrink tubing over individual conductors

FLEET WIRE INSPECTION & REPAIR SUMMARY

Presenter:
Doug White
Organization/Date:
Orbiter/11-19-99

Discussion:

- All other areas where wire bundles are routinely flexed during processing or flight have been assessed
  - RMS jettison pyro
    - Wires are visible
    - Inspected as part of the overall wire inspections
  - Flight deck CRT displays
    - Displays are pulled and cables are demated/remated during V6018.001 CABIN AIR INSP. & MAINT
    - Wires are visible
    - Inspected as part of the OMI maintenance

FLEET WIRE INSPECTION & REPAIR SUMMARY

Presenter:
Doug White
Organization/Date:
Orbiter/11-19-99

Long-term Corrective Actions

- Return to original, strict interpretation of wiring inspection specification
  - Spec clarification revision release — 1/3/00
- Permanently increase wire inspection thoroughness during area closeout
  - Closeout inspection instructions revised — 1/15/00
  - Gather data during Palmdale inspections to characterize inspection effectiveness — ongoing
- Review wiring protection modifications and standardize wire protection across the fleet by drawing
  - Drawings released, current protection— 12/22/99
  - Drawings released, rest of vehicle — 3/31/00

FLEET WIRE INSPECTION & REPAIR SUMMARY

Presenter:
Doug White
Organization/Date:
Orbiter/11-19-99

Long-term Corrective Actions

- Change human factors which lead to mechanically induced damage
  - GSE redesign:
    - Platform redesign at KSC — 2/29/00
    - Platform redesign at Palmdale — 2/29/00
  - Temporary wire protection during work in an area — 12/15/99
  - Training:
    - General wire protection awareness for all Orbiter access — 1/15/00
    - Wire inspection certification course — 1/15/00
- Study use of new types of wiring insulation, as required, for specific applications
  - Study complete — 2/11/00
  - Incorporate in new designs as necessary

FLEET WIRE INSPECTION & REPAIR SUMMARY

Presenter: Doug White

Organization/Date: Orbiter/11-19-99

Long-term Corrective Actions

- Complete planned wiring age/life characterization testing

Test #	Test Name	Start Date	End Date
3.2	Microscopic Examination	11/27/99	11/24/99
3.3	Dielectric Strength Test	11/24/99	11/30/99
3.4	Insulation Shrinkage Test	11/30/99	12/03/99
3.5	Vacuum Cold Bend Test	12/20/99	01/15/00
3.6	Insulation Durability Test (NTL)		
3.7	Cut-Through Resistance Test (NTL)		
3.8	Fluid Resistance Test	11/30/99	12/10/99
3.9	Flammability Test (WSTF)	01/03/00	01/15/00
3.10	Life Cycle Test	11/30/99	12/15/99
3.11	Hydrolysis Test (Lectromech)	01/03/00	01/15/00
3.12	Single Axis Crush Test	11/24/99	12/10/99
3.13	Single Axis Impact Test	11/24/99	12/10/99
3.14	Notch Sensitivity Test	11/24/99	12/10/99
3.15	Age/Life Evaluation (Lectromech)	01/03/00	01/15/00

←Purchase order and dates in negotiation with NTL

←Purchase order in negotiation with Lectromech

FLEET WIRE INSPECTION & REPAIR SUMMARY

Presenter:
Doug White
Organization/Date:
Orbiter/11-19-99

Long-term Corrective Actions

- Review Orbiter crit 1 function routing and design
  - Update 1994 routing study with design changes that have occurred since — 4/4/00
  - Propose design changes, where possible, to re-route redundancies contained within a single bundle —
    - Design changes to VECB 4/12/00
    - 100% engineering release 9/8/00
  - Propose design changes, where possible, to eliminate single-wire crit 1/1 functions — 2/11/00
- Review other specifications where configuration is determined by technician judgment and standardize to engineering requirement as necessary
  - Spec review complete — 2/11/00
  - Drawings released — TBD

FLEET WIRE INSPECTION & REPAIR SUMMARY

Presenter:
Doug White
Organization/Date:
Orbiter/11-19-99

Long-term Corrective Actions

- Apply lessons learned to other Orbiter systems
  - USA self-initiated assessment of maintenance and refurbishment practices
    - Assessment initiated on 10/25/99 will be complete in 120 days — 2/25/00
    - Systems under review
      - Hydraulics
      - Hypergolics
      - Avionics
      - Mechanisms/Structures
      - Risk management

FLEET WIRE INSPECTION & REPAIR SUMMARY

Presenter:
Doug White
Organization/Date:
Orbiter/11-19-99

Acceptable for Flight:

- Root cause is work-induced damage
  - OV-103 has been screened by a logical criteria and identified areas have been methodically inspected
  - Damage has been repaired and wiring protection has been added per spec
  - Confidence testing performed
- Potential still exists for damage in uninspected areas
- If undetected damage exists, consequences of damage are mitigated by Orbiter design
  - Orbiter electrical circuits contain design features (circuit breakers, fuses, RPCs, current-limiting resistors, etc.) to protect against effect of short circuits, including arc tracking
    - Arc tracking tests performed by JSC (1990) confirmed the effectiveness of Orbiter circuit protection devices
  - Critical Orbiter functions are redundantly powered
    - Most redundant power routed through separate wire bundles with maximum feasible physical separation

GEAR CYCLE LIFE TEST FAILURE OV-101 NOSE LANDING GEAR LOCKBRACE BUNGEE CRANK

Presenter: Doug White

Organization/Date: Orbiter/11-19-99

Observation:

- OV-101 Nose Landing Gear (NLG) lockbrace bungee crank failed near upper attach fitting during gear cycle 2424 of certification extension test series
- During bungee crank investigation, bungee assy found to be not per print and damaged

Concern:

- Similar defects in NLG bungee/crank & MLG bungees on flight vehicle hardware

GEAR CYCLE LIFE TEST FAILURE OV-101 NOSE LANDING GEAR LOCKBRACE BUNGEE CRANK	Presenter: Doug White
	Organization/Date: Orbiter/11-19-99

Acceptable for STS-103 Flight:

- Bungee failure analysis indicates that dry film wear on spring and housing and over size spring caused higher load output
- Successful inspection of bungee system weak links verified overload condition is not present
  - NLG bell crank eddy current
  - MLG lower attachment cross bolt hole measurement
- Final gear functional in OPF demonstrated proper operation

GEAR CYCLE LIFE TEST FAILURE OV-101 NOSE LANDING GEAR LOCKBRACE BUNGEE CRANK	Presenter: Doug White
	Organization/Date: Orbiter/11-19-99

Discussion:

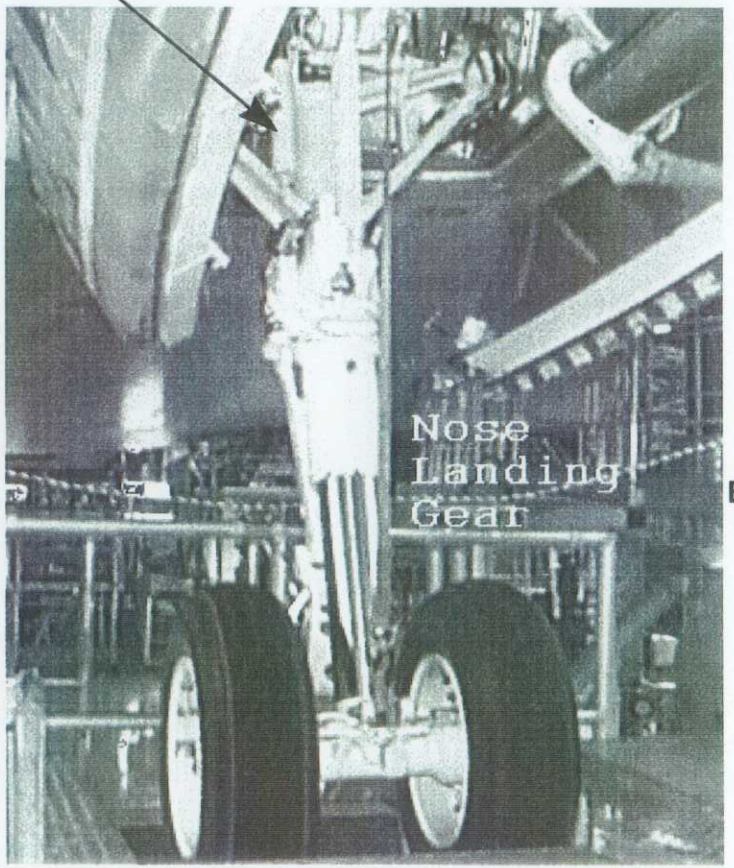
- OV-101 NLG being utilized for gear cycle life test program at JSC
  - Successfully completed 2,000 cycles
  - Running last 1,000 cycles (3,000 cycles was test goal)
  - Test program was developed to assess the possibility of extending the main and nose landing gear cycle life past 400 cycles
  - Fracture/fatigue in extended certification not an issue, only dry film wear concern on rotational pins

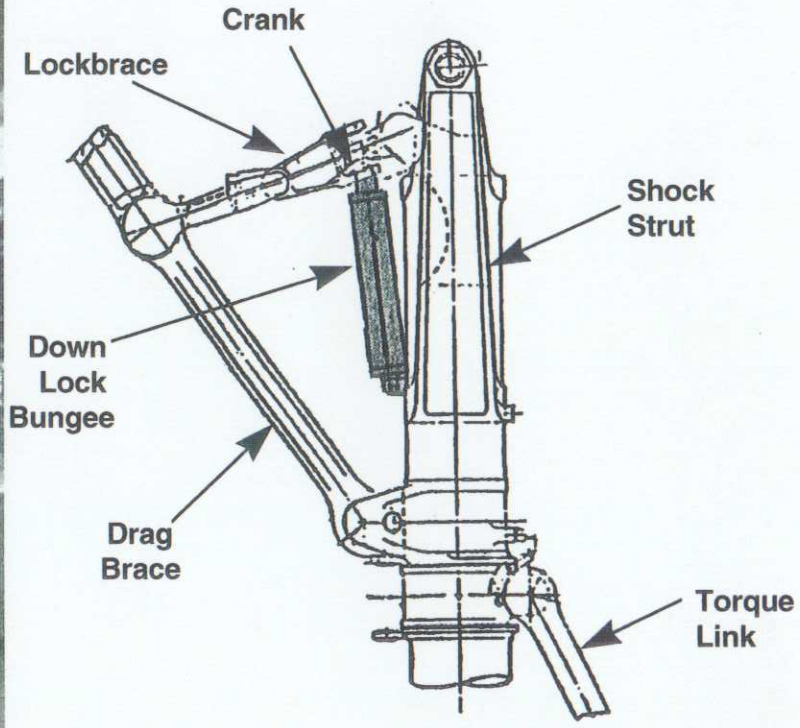
GEAR CYCLE LIFE TEST FAILURE OV-101 NOSE LANDING GEAR LOCKBRACE BUNGEE CRANK

Presenter: Doug White

Organization/Date: Orbiter/11-19-99

Nose Landing Gear



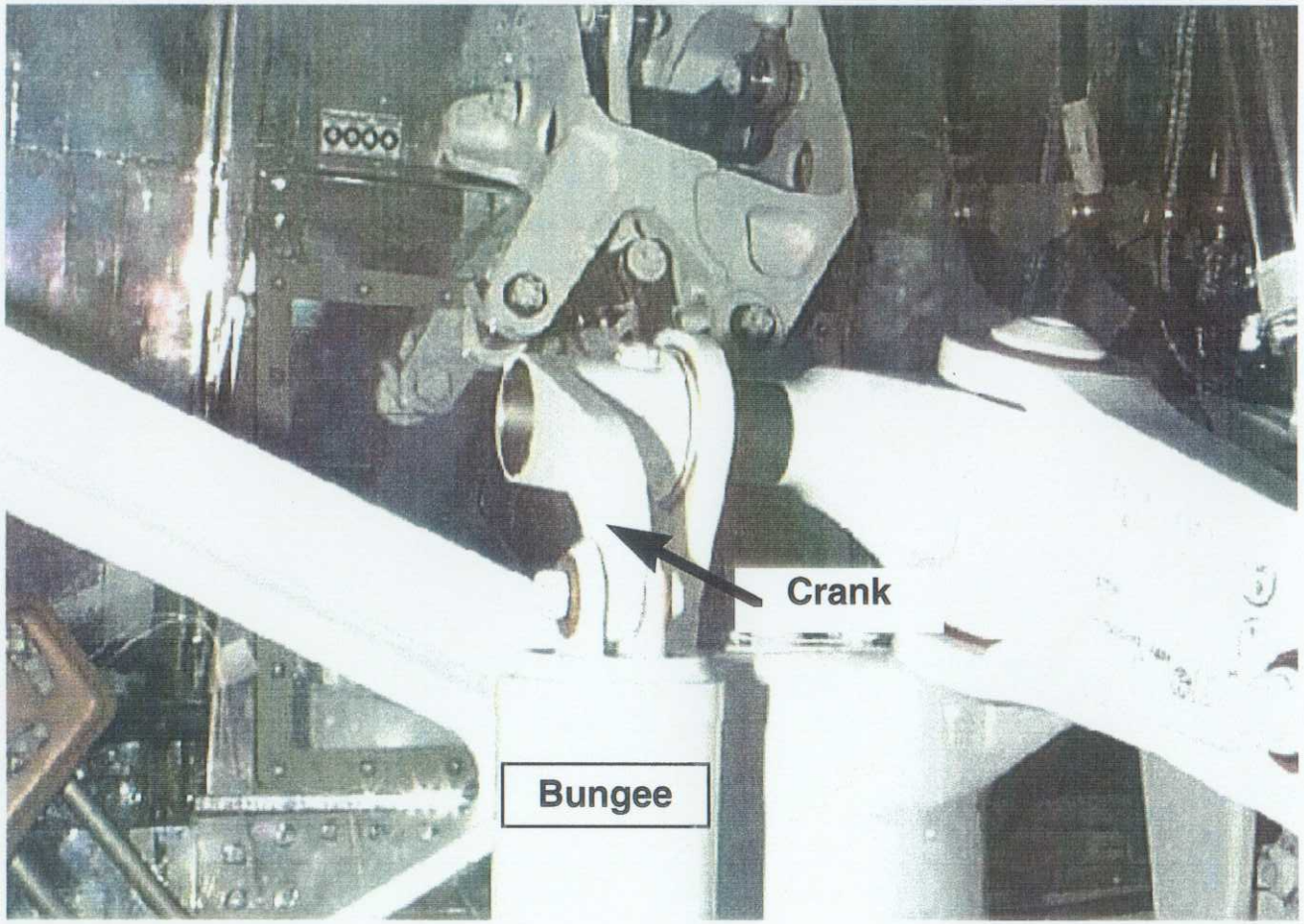


GEAR CYCLE LIFE TEST FAILURE OV-101 NOSE LANDING GEAR LOCKBRACE BUNGEE CRANK

Presenter:
Doug White

Organization/Date:
Orbiter/11-19-99

Nose Landing Gear

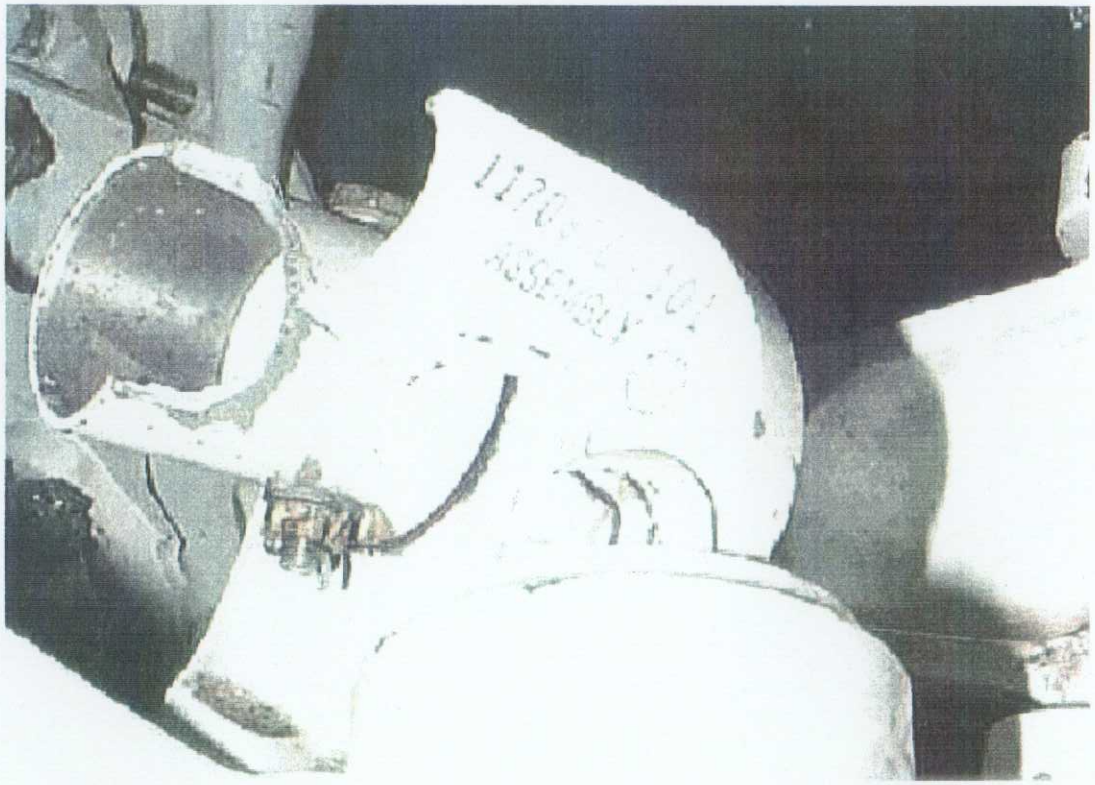


GEAR CYCLE LIFE TEST FAILURE OV-101 NOSE LANDING GEAR LOCKBRACE BUNGEE CRANK

Presenter:
Doug White

Organization/Date:
Orbiter/11-19-99

Failed NLG Lockbrace Bungee Crank



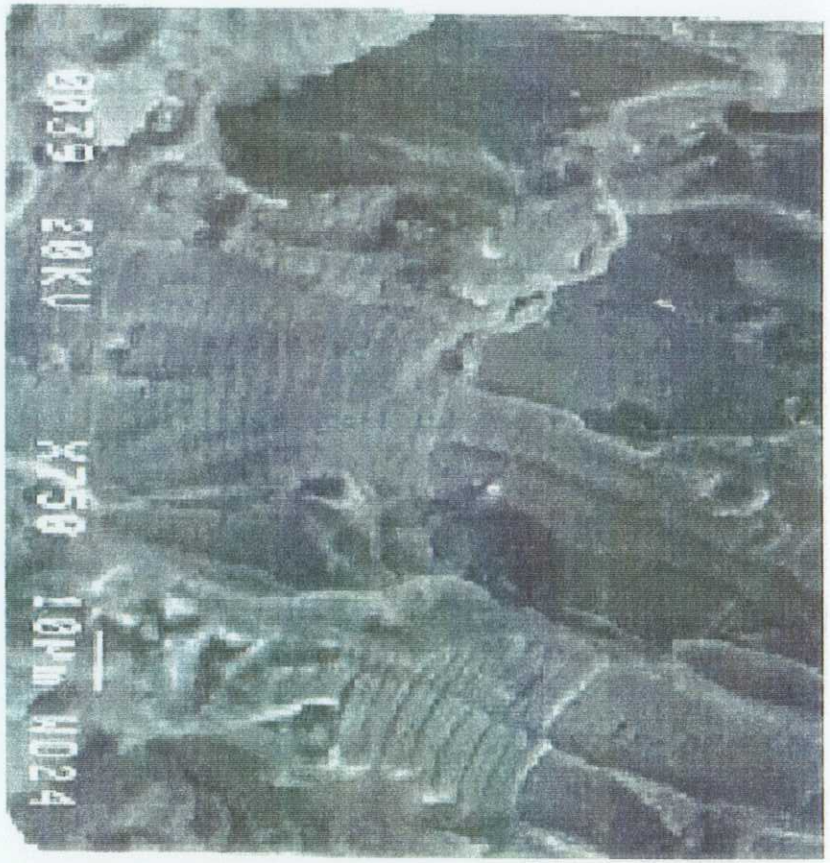
GEAR CYCLE LIFE TEST FAILURE OV-101 NOSE LANDING GEAR LOCKBRACE BUNGEE CRANK	Presenter: Doug White
	Organization/Date: Orbiter/11-19-99

Discussion:

- Bungee crank sent to NASA/JSC metallurgical lab for failure analysis
  - Multiple initiation sites were found along the ID surface of the tube
    - Fatigue was not initiated at a pre-existing flaw
  - The primary initiation site was at the ID, outboard corner of the tube (vehicle orientation)
  - Striations found were consistent with the gear deployment cycles
  - Conductivity measurements are consistent with 7075-T7 aluminum alloy
  - Hardness measurements verified T73 heat treatment
  - Failure of the crank tube was initiated in fatigue, followed by a fast fracture, overload surface

GEAR CYCLE LIFE TEST FAILURE OV-101 NOSE LANDING GEAR LOCKBRACE BUNGEE CRANK

Presenter: Doug White
Organization/Date: Orbiter/11-19-99



NLG Bungee Crank Typical Fatigue Striations

GEAR CYCLE LIFE TEST FAILURE OV-101 NOSE LANDING GEAR LOCKBRACE BUNGEE CRANK	Presenter: Doug White
	Organization/Date: Orbiter/11-19-99

Discussion: (Cont)

- Removed NLG bungee crank from test assy
  - NLG downlock bungee completed load/stroke test
    - Approximately double load required to achieve the working stroke of 4.25 inch
      - 546 lbs measured vs 282 lbs expected
    - Large hysteresis observed during return cycle
  - "Popping" noise heard during load/stroke test of bungee
    - Same "popping" noise observed during gear cycle life test program from the 810th cycle and continuing to the 2424th cycle
  - Black powder observed coming out of bungee cylinder vent hole
- NLG downlock bungee shipped to B.F. Goodrich Landing Gear (Menasco) Euless,Texas, for TT&E

GEAR CYCLE LIFE TEST FAILURE OV-101 NOSE LANDING GEAR LOCKBRACE BUNGEE CRANK	Presenter: Doug White
	Organization/Date: Orbiter/11-19-99

Discussion: (Cont)

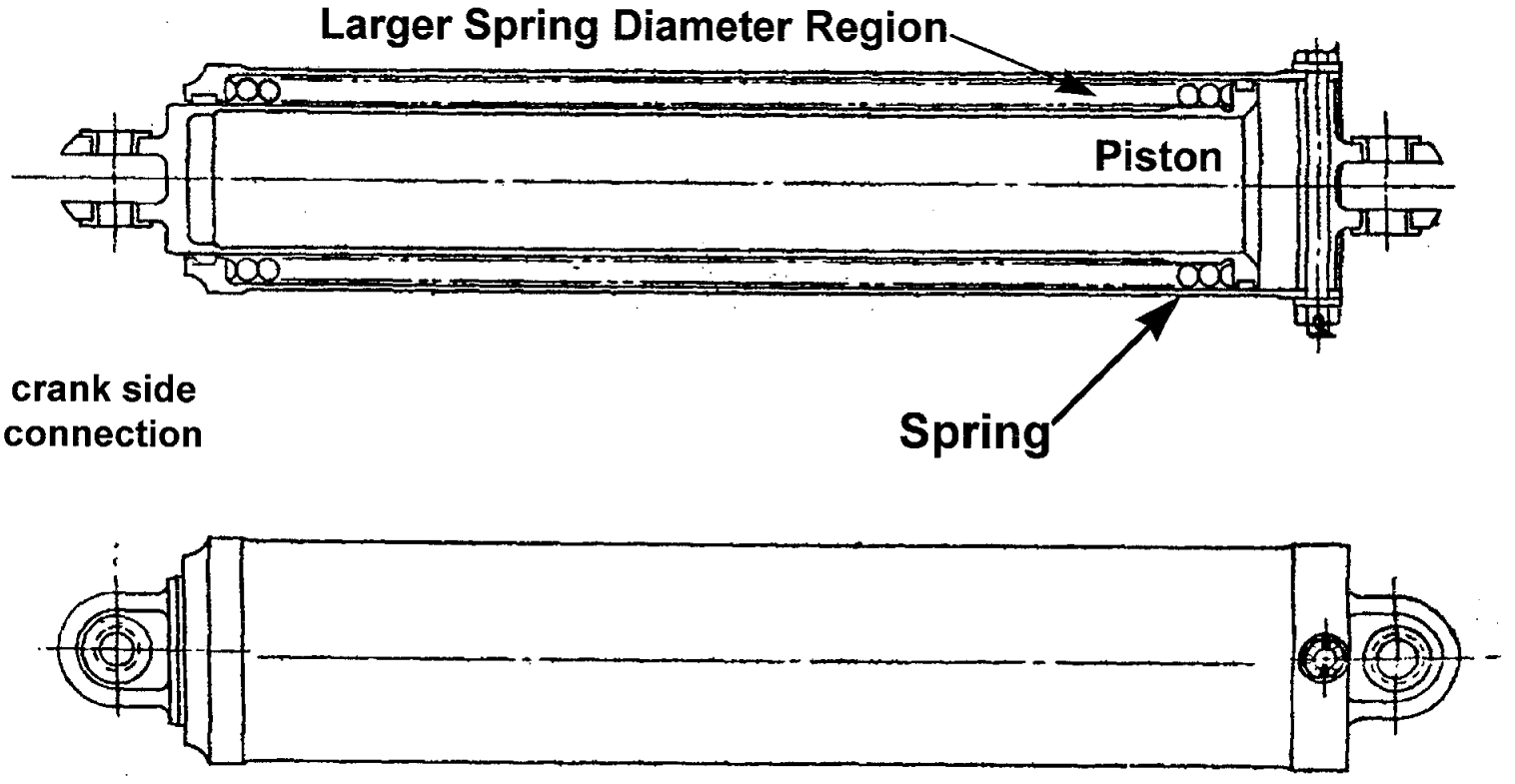
- NLG downlock bungee failure analysis at B.F. Goodrich Landing Gear Co.
  - Spring measured to be larger than diameter of cylinder bore
    - Measured to be .011" interference and should have been .038" clearance only at piston end of spring
  - Spring surface has significant dry film wear
  - Spring surface had been flattened
  - Bore of cylinder was within drawing requirements
  - Bungee cylinder ID has significant dry film wear
  - Black powder found inside cylinder determined to be worn off loose dry film and spring/cylinder material
  - Bungee failure analysis indicates that dry film wear on spring and housing and oversized spring caused higher load output
- MLG bungee suspect due to similar design

GEAR CYCLE LIFE TEST FAILURE OV-101 NOSE LANDING GEAR LOCKBRACE BUNGEE CRANK

Presenter: Doug White

Organization/Date: Orbiter/11-19-99

Cross Section Of NLG Bungee

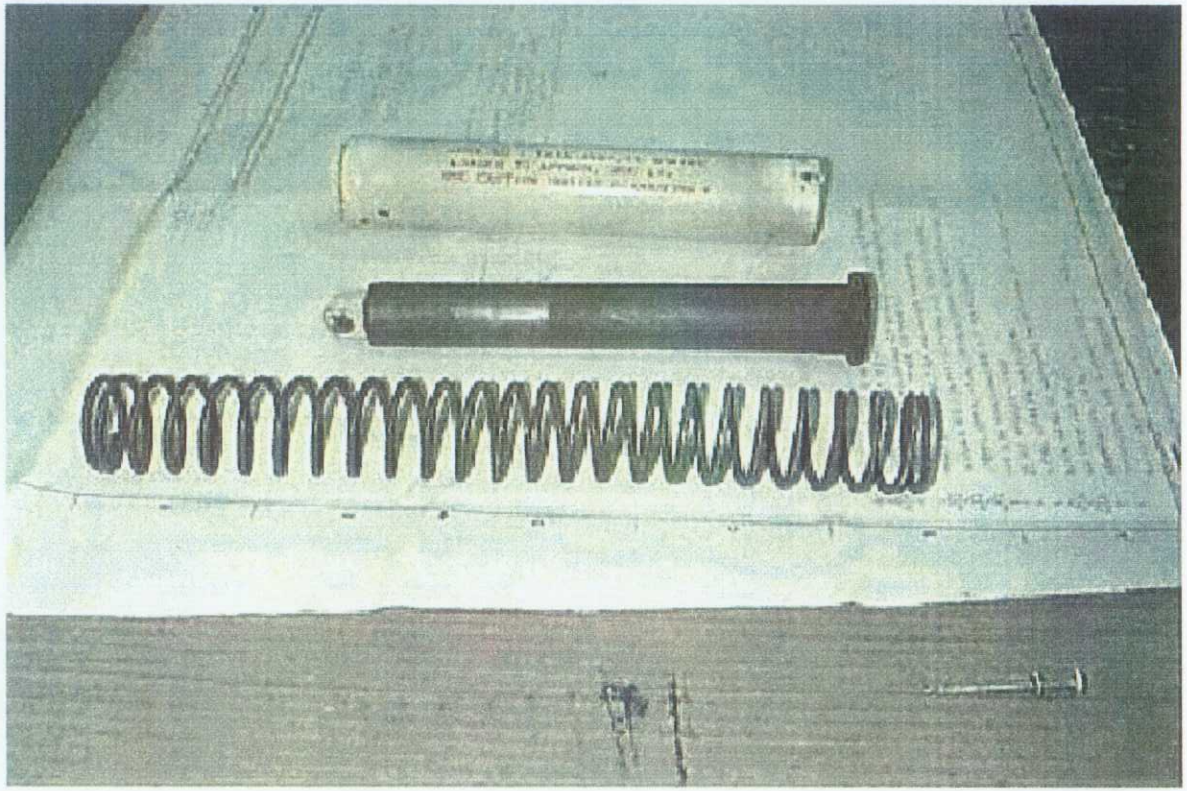


GEAR CYCLE LIFE TEST FAILURE OV-101 NOSE LANDING GEAR LOCKBRACE BUNGEE CRANK

Presenter:
Doug White

Organization/Date:
Orbiter/11-19-99

Disassembled OV-101 NLG Lockbrace Bungee

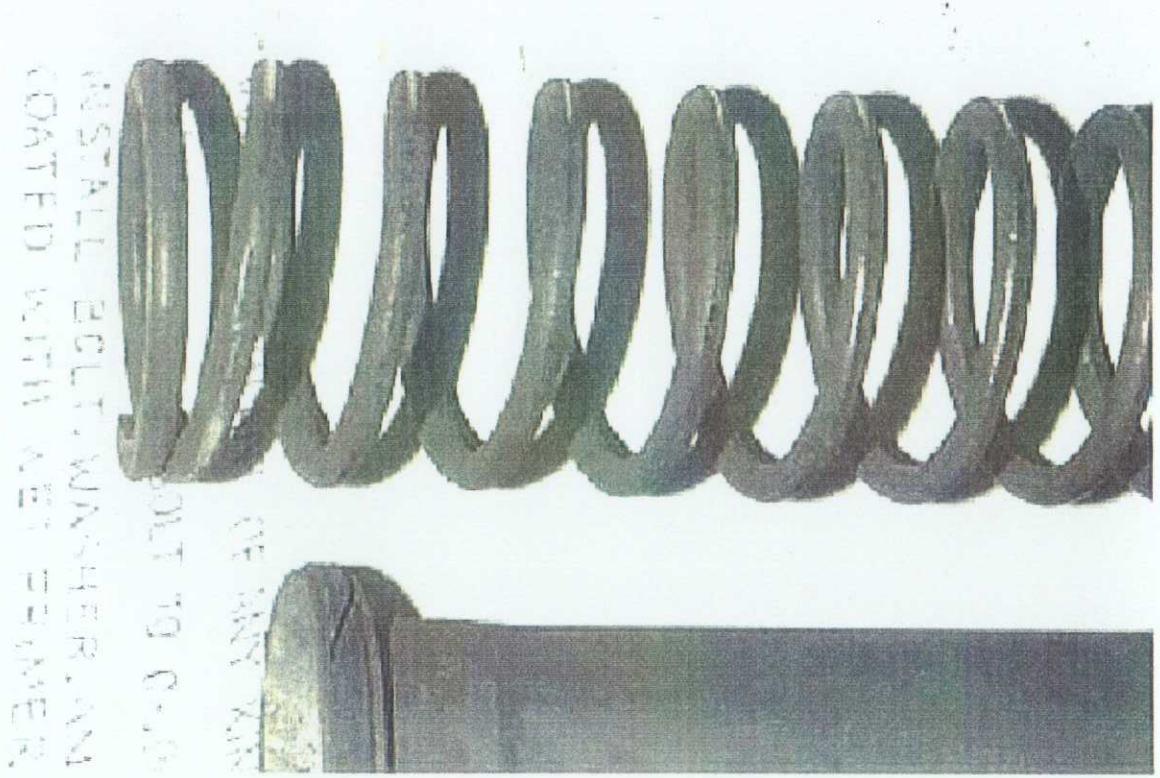


GEAR CYCLE LIFE TEST FAILURE OV-101 NOSE LANDING GEAR LOCKBRACE BUNGEE CRANK

Presenter:
Doug White

Organization/Date:
Orbiter/11-19-99

OV-101 NLG Bungee Spring With Dry Film Wear



GEAR CYCLE LIFE TEST FAILURE OV-101 NOSE LANDING GEAR LOCKBRACE BUNGEE CRANK	Presenter: Doug White
	Organization/Date: Orbiter/11-19-99

Analysis of OV-101 Nose Gear Failure:

- Math model by JSC SR&QA confirms stress concentration near area of failure on bungee crank
  - Bungee load of 550 lb gives maximum tension stress of 39 ksi
- Fatigue analysis concluded ~700 lb bungee load would be needed for failure at 2400 cycles
- Can approximately predict fatigue failure from bungee overload
  - Some variability possible on 550 lb value for friction
- Fracture analysis (with standard 0.05" flaw size) concluded a 780 lb bungee load for at least an additional 50 cycles required for failure
- Analyzed rest of bungee system to confirm crank is critical part by a significant margin
  - Next critical part carries 2100 lb
  - Crank is right place to inspect
- Visual/eddy current/x-ray inspections completed on NLG bungee crank
  - All nominal

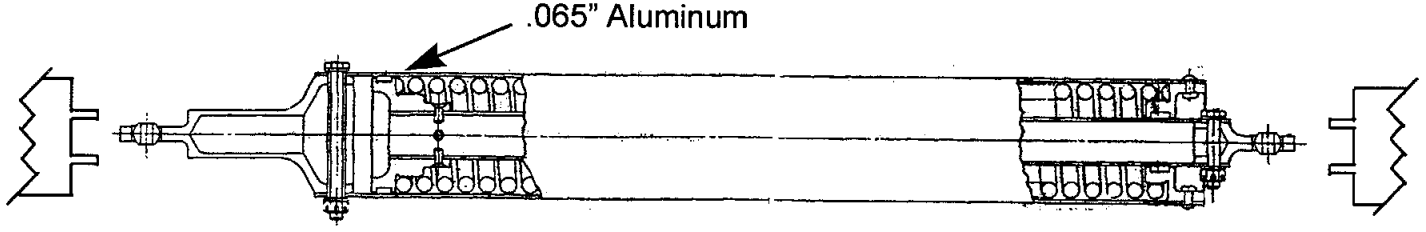
GEAR CYCLE LIFE TEST FAILURE OV-101 NOSE LANDING GEAR LOCKBRACE BUNGEE CRANK

Presenter: Doug White

Organization/Date: Orbiter/11-19-99

Analysis of Main Gear System:

- Main gear bungee similar clearance, longer stroke, maximum operating load = 578 lb
- Evaluated main gear system capability to tolerate friction



Lug On Shock Strut	Pin	End Fitting Lug	Cross Bolt	Bearing Tearout Of Cylinder		Bearing Tearout Of Piston	Cross Bolt	End Fitting Lug	Lug On Lock Brace
26000 lb*	15000 lb*	6000 lb*	4400 lb*	2400 lb*		2400 lb*	5600 lb*	6000 lb*	26000 lb*

* Ultimate

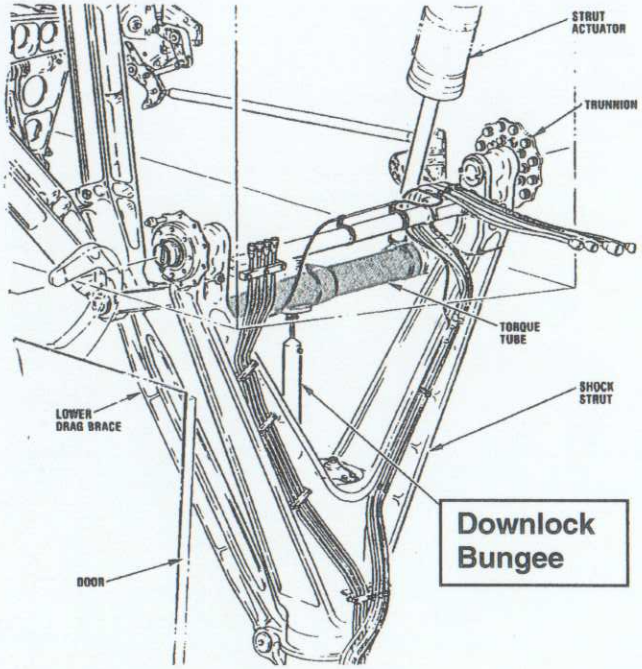
- Main gear has more tolerance for friction 580 lb vs. 2400 lb
- Shock strut end fitting cross bolt hole elongation would be first indication of overload

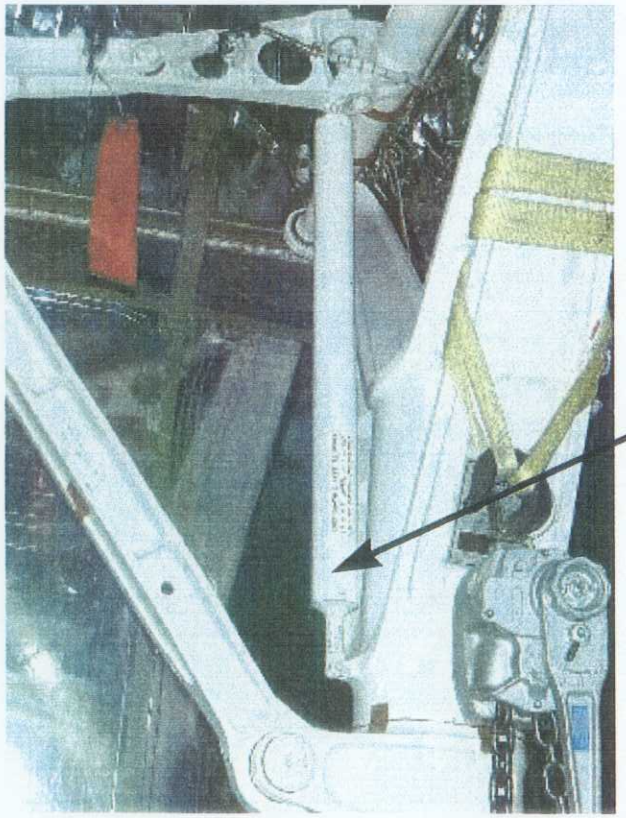
GEAR CYCLE LIFE TEST FAILURE OV-101 NOSE LANDING GEAR LOCKBRACE BUNGEE CRANK

Presenter:
Doug White

Organization/Date:
Orbiter/11-19-99

MLG Downlock Bungee





GEAR CYCLE LIFE TEST FAILURE OV-101 NOSE LANDING GEAR LOCKBRACE BUNGEE CRANK	Presenter: Doug White
	Organization/Date: Orbiter/11-19-99

Discussion: (Cont)

- MLG bungee removal assessed for physical/detailed inspection
  - Found to be not feasible, special tooling not available at B.F. Goodrich landing gear
- Measurement of lower MLG bungee cross bolt hole indicated to be within stress allowables
  - 0.008" Hole elongation in load path (equal to 2% allowed)
- Bungee noise and powder emission from bungee vent hoses to be monitored during planned cycle

Risk Assessment:

- MLG bungee & NLG bungee/crank are 1R2
  - CIL 02-1A-079-1
  - Possible loss of mission/vehicle with two failures, loss of downlock bungee and loss of extend actuator

GEAR CYCLE LIFE TEST FAILURE OV-101 NOSE LANDING GEAR LOCKBRACE BUNGEE CRANK	Presenter: Doug White
	Organization/Date: Orbiter/11-19-99

Acceptable for STS-103 Flight:

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  - MLG lower attachment cross bolt hole measurement
- Final gear functional in OPF demonstrated proper operation

D&C PANEL C3 MAIN ENGINE SHUTDOWN SWITCH MARKING ERROR

Presenter:
Doug White

Organization/Date:
Orbiter/11-19-99

Observation:

- Supplemental crew preference decal for Main Engine Shutdown switch on Panel C3 was found to be in error
  - Was misidentified with Control Bus AB2, should have been BC1
- Subsequent review of all 253 crew preference decal drawings revealed 3 additional errors
  - Panel O7 LH RCS XFEED 3/4/5 (sw 33)
    - Decal indicates AC2, should be AC1
  - Panel L1 RAD BPV MODE (sw 35)
    - Decal indicates MNB, should be MNC
  - Panel L1 RAD BPV MODE (sw 36)
    - Decal indicates MNC, should be MNB

D&C PANEL C3 MAIN ENGINE SHUTDOWN SWITCH MARKING ERROR

Presenter: Doug White

Organization/Date: Orbiter/11-19-99

Concerns:

(1) Drawing errors may affect:

(a) Vehicle as-built configuration and switch function

(b) Flight crew/flight controller training and procedures

(2) Crew preference decals do not match as-built configuration

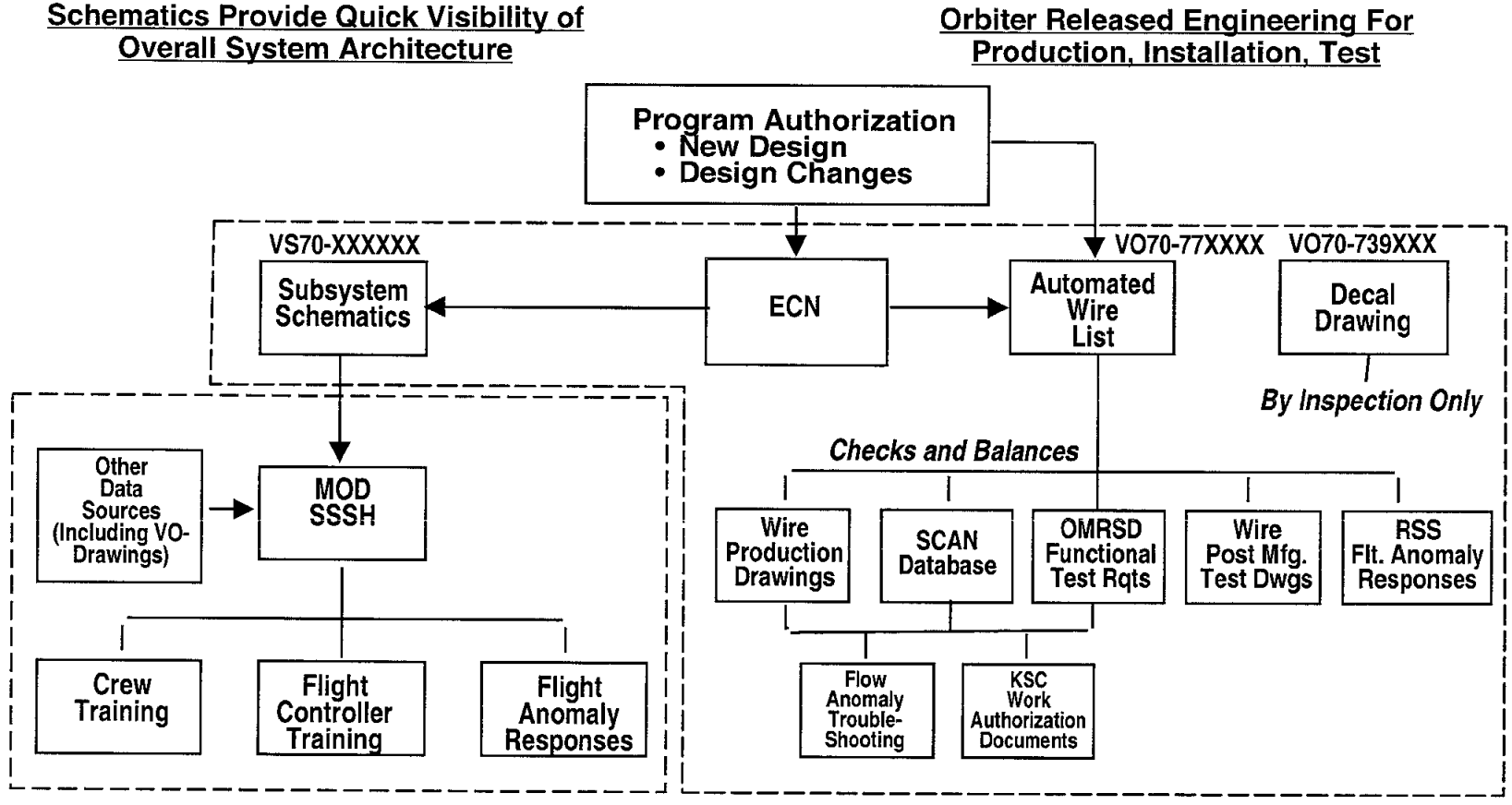
(3) Process breakdowns between engineering drawings, reference schematics, and operations training/procedures

D&C PANEL C3 MAIN ENGINE SHUTDOWN SWITCH MARKING ERROR

Presenter:
Doug White

Organization/Date:
Orbiter/11-19-99

AWL Is The CM-Controlled Foundation of Orbiter Wiring; Orbiter Schematic Drawings Are Released But Not CM-Controlled



D&C PANEL C3 MAIN ENGINE SHUTDOWN SWITCH MARKING ERROR

Presenter: Doug White

Organization/Date: Orbiter/11-19-99

Discussion:

- Concern (1a)
  - Performed special test to verify proper function of main engine shutdown switch
  - Testing in-work to verified correct functionality of remaining mislabeled switches

D&C PANEL C3 MAIN ENGINE SHUTDOWN SWITCH MARKING ERROR

Presenter:
Doug White

Organization/Date:
Orbiter/11-19-99

Discussion:

- Concern (1b)
  - Defined scope of audit to establish risk of using Subsystem Schematics in SSSH - coordinated scope with MOD & FCOD
    - 26 Crit 1/1 items (7,700 circuit elements)
    - Large sample of complex MPS circuits (2,100 circuits/ 12,800 circuit elements)
  - Performed audit to establish confidence level in schematics
  - Compared schematics to AWL to confirm wire-to-wire, connection-to-connection, pin-by-pin agreement
  - Also examined all ascent/entry time critical procedures for buss loss
    - To determine risk when time critical actions require perfection

D&C PANEL C3 MAIN ENGINE SHUTDOWN SWITCH MARKING ERROR

Presenter: Doug White

Organization/Date: Orbiter/11-19-99

Discussion:

- Subsystem Schematics vs. AWL Review Results

Number of Circuit Elements Reviewed	Crit. 1/1 Item Review *7,700*	MPS Schematic Review *12,800*	Totals *20,500*
Incorrect Representation of Orbiter Function	0	0	0
Incorrect LRU Descriptive Names	0	0	0
Missing Information	47	34	81
Incorrect Information	19	21	40
		Total Errors =	121
		Accuracy Rate =	99.4%

- MOD review of findings noted one area which will require a minor change in an SSSH drawing associated with APU fuel line heater configuration
- No errors found in ascent/entry buss loss procedures

D&C PANEL C3 MAIN ENGINE SHUTDOWN SWITCH MARKING ERROR

Presenter:
Doug White

Organization/Date:
Orbiter/11-19-99

Discussion:

- Concern (2)
  - Determined that decal installation drawings were incorrect for 4 of 253 drawings
  - Traced all 4 drawing errors to original release (1983)
    - Most probable cause was human error
  - Issued engineering to correct decals
  - Inspection to confirm that all installed labels are correct is in-work
  - Decal drawings were only verified by inspection (not test)
    - Action in-work to establish a system to "test" labels as part of the installation process

D&C PANEL C3 MAIN ENGINE SHUTDOWN SWITCH MARKING ERROR

Presenter: Doug White

Organization/Date: Orbiter/11-19-99

- Concern (3)
  - Process breakdowns between engineering drawings, reference schematics, and operations training/ procedures must be fixed
  - PRCB action assigned to ensure crew/flight controller training and procedures are based on the same reliable foundation that controls the vehicle as-built configuration
    - Scheduled to return to PRCB 12/99

D&C PANEL C3 MAIN ENGINE SHUTDOWN SWITCH MARKING ERROR

Presenter:
Doug White

Organization/Date:
Orbiter/11-19-99

Risk Assessment:

- During examination of subsystem schematic drawings no technical errors that would affect Orbiter functions were identified
- Engineering review in addition to vehicle testing confirmed that the Orbiter is wired per design
- Engineering released to correct 4 decals for all vehicles
- MOD assessment of SSSH documentation has identified 2 impacts from decal and subsystem schematic errors
  - Center engine decal and APU fuel line heater callout
  - Corrective actions in crew training and flight data file products are in-work

D&C PANEL C3 MAIN ENGINE SHUTDOWN SWITCH MARKING ERROR

Presenter:
Doug White

Organization/Date:
Orbiter/11-19-99

Acceptable for STS-103 Flight:

- Four erroneous decals corrected and switch functions verified
- All other supplemental crew preference decals currently installed on the vehicle have been verified to be consistent with vehicle wiring
- MOD review of schematic errors confirmed there was only one discrepancy which impacted flight crew/flight controller documentation
- MOD has addressed the flight controller/flight crew documentation and training items associated with the discrepant decals and the schematic audit

RCS OXIDIZER MANIFOLD 5 ISOLATION VALVE

Presenter:
Brian Werner
Organization/Date:
Orbiter/11-19-99

Observation:

- RCS oxidizer manifold 5 isolation valve (S/N 025) on OV-103, RP03, valve position indicated CLOSED when commanded OPEN
  - Corrosion of the electrical connector was found with a steady reading of 1.0 ppm oxidizer at the connector
- OMS vapor isolation valve PR reported on LV506 on RP03 prior to STS-70 - valve position indicated OPEN when commanded CLOSE
  - UA reoccurred during STS-103 flow

Concern:

- External leakage creates hazardous environment
  - Remote potential for auto-ignition in fuel valve
- Loss of valve position indication and/or function in these valves or other valves using same material
  - Vernier thruster valve

RCS OXIDIZER MANIFOLD 5 ISOLATION VALVE

Presenter:
Brian Werner
Organization/Date:
Orbiter/11-19-99

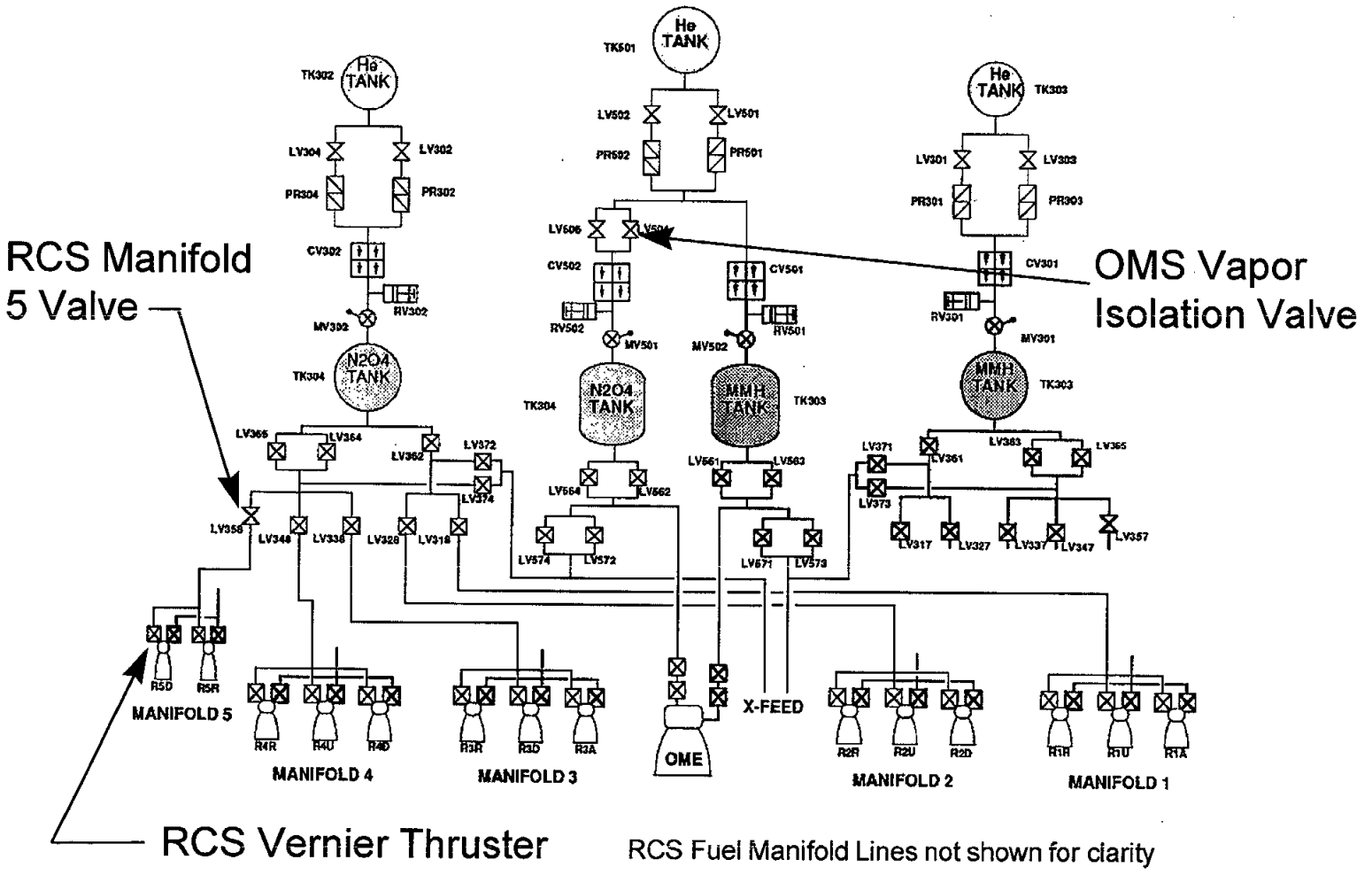
Acceptable for STS-103 Flight:

- Failed ox manifold isolation valve has been removed and replaced
  - Replacement valve has passed OMRSD retest requirements
  - All OV-103 manifold 5 isolation valves have been inspected visually and with sniff checks and no anomalies were noted
    - External leakage through the valve is an inspectable condition
- Intergranular corrosion with AM355 is a very slow process
  - Valve exposed to oxidizer for 15 years
- Oxidizer leakage into valve first manifests itself as VPI problem
  - Initial indication of problem occurred two years ago as intermittent VPI
  - No effect on valve function
- Subsystem redundancy and flight rules exist for worst-case failed open/close manifold 5 valve and vapor isolation valve
- No concern with intergranular corrosion in the fuel manifold 5 valve
- No concern with RCS vernier thruster valve

RCS OXIDIZER MANIFOLD 5 ISOLATION VALVE

Presenter: Brian Werner
Organization/Date: Orbiter/11-19-99

AFT PROPULSION SYSTEM - RIGHT SIDE



RCS OXIDIZER MANIFOLD 5 ISOLATION VALVE

Presenter:
Brian Werner
Organization/Date:
Orbiter/11-19-99

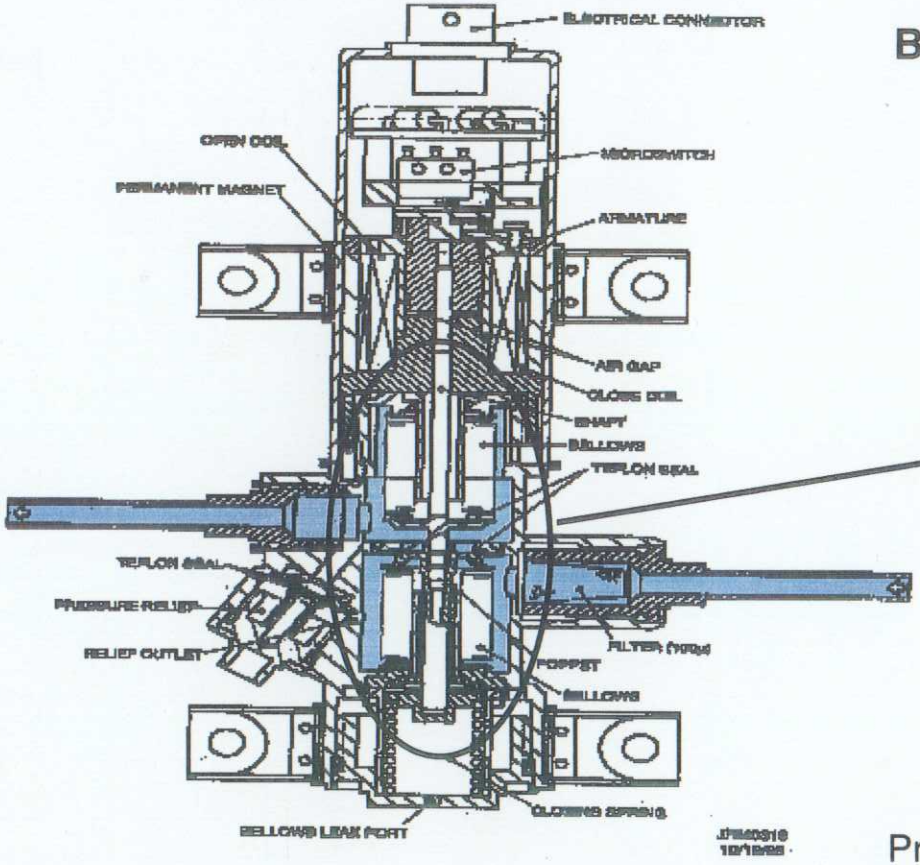
RCS Manifold 5 Isolation Valve Discussion:

- S/N 25 valve had momentary loss of open position indication during the STS-85 launch (8/8/97)
- Inspection of the valve electrical connector revealed nitrate corrosion
  - Slight oxidizer reading measured one time
  - Could not be repeated — attributed to technique
- Pod electrical connector and adjacent wiring were removed and replaced
- Valve electrical connector was cleaned
- Subsequent valve cycling was performed with no anomalies
- Problem closed with corrosion as cause of anomaly

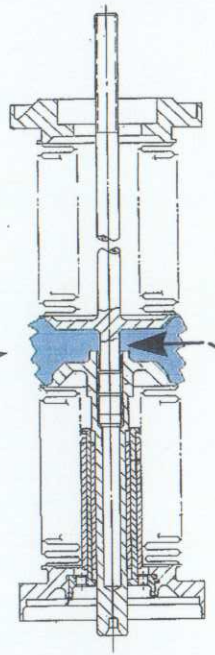
RCS OXIDIZER MANIFOLD 5 ISOLATION VALVE

Presenter:
Brian Werner
Organization/Date:
Orbiter/11-19-99

RCS Manifold 5 Isolation Valve



Bellows/Poppet Assy



Propellant path through inner threads of poppet

Propellant path shown in color

RCS OXIDIZER MANIFOLD 5 ISOLATION VALVE

Presenter:
Brian Werner
Organization/Date:
Orbiter/11-19-99

RCS Manifold 5 Isolation Valve Discussion: (Cont)

- During STS-103 flow, another position indication failure on S/N 25 was detected during valve cycling (9/01/99)
  - Did not get open indication when valve commanded open
- Troubleshooting of vehicle wiring isolated problem to valve
- Verified proper valve operation and demated electrical connector
- Corrosion and oxidizer vapor found on electrical connector
- Valve was x-rayed to determine internal valve condition
  - No anomalies noted
- Inspected all OV-103 fuel and oxidizer manifold 5 isolation valves
  - Cycled the valves to check position indicators
  - Disconnected and inspected electrical connectors for corrosion
  - Sniffed the valves for the appropriate propellant vapor
- No indication of corrosion or leakage found on other OV-103 manifold 5 isolation valves

RCS OXIDIZER MANIFOLD 5 ISOLATION VALVE

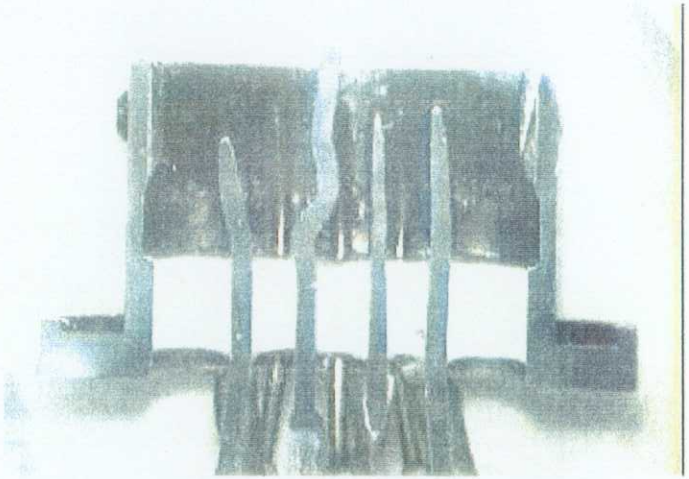
Presenter: Brian Werner
Organization/Date: Orbiter/11-19-99

RCS Manifold 5 Isolation Valve Discussion: (Cont)

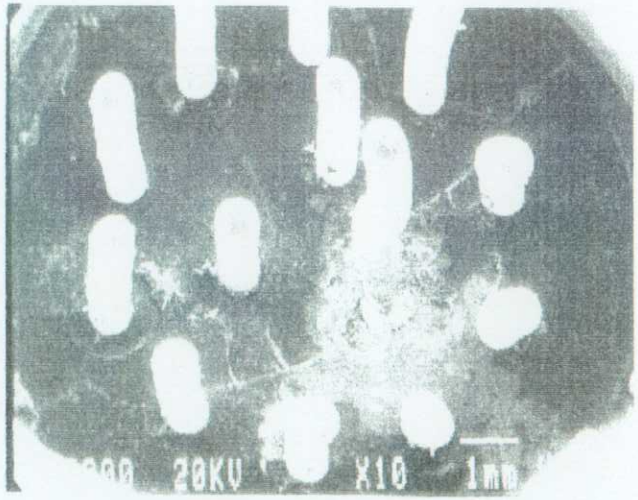
- Valve was removed and sent to EVAD for TT&E
- TT&E revealed a second failure: glass hermetic seal in electrical connector was cracked
  - One pin was bent and slightly pulled out
  - F/A indicates bending and pull-out of the protruding pin contributed to cracks in glass seal
    - No evidence of a generic condition
    - Further analysis is in work
  - Leakage external to the valve was only detectable because of the crack in the connector glass seal
- Microswitch failed in closed position
  - Intermittent high contact resistances measured
  - Severe corrosion found on the spring mechanism
  - Switch contacts covered with corrosion products
  - Plastic plunger mechanism intact

RCS OXIDIZER MANIFOLD 5 ISOLATION VALVE

Presenter:
Brian Werner
Organization/Date:
Orbiter/11-19-99



Cross Section of Electrical Connector/ Glass Hermetic Seal

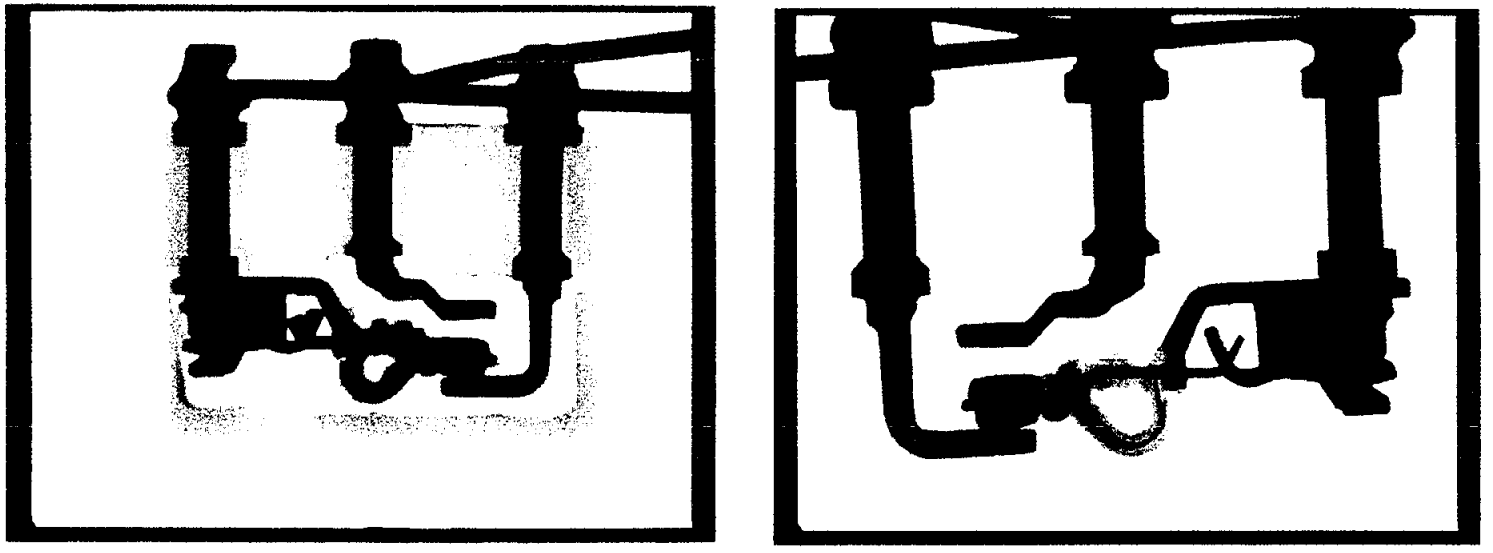


SEM Photograph of Crack in Seal Around Bent Pin

RCS OXIDIZER MANIFOLD 5 ISOLATION VALVE

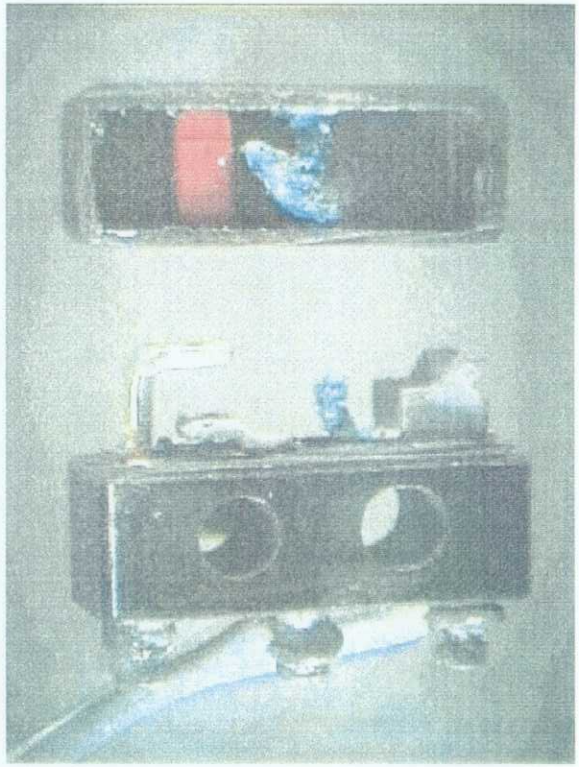
Presenter:
Brian Werner
Organization/Date:
Orbiter/11-19-99

X-Ray Of Oxidizer Manifold 5 Valve Microswitch

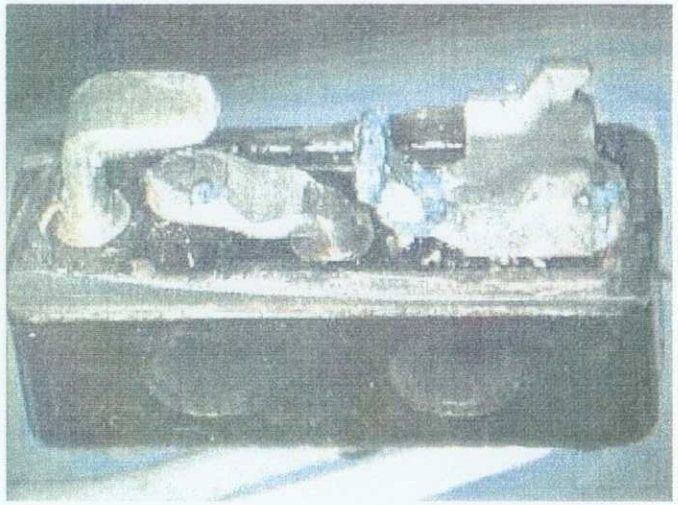


RCS OXIDIZER MANIFOLD 5 ISOLATION VALVE

Presenter:
Brian Werner
Organization/Date:
Orbiter/11-19-99



Sectioned Microswitch



Switch Spring Mechanism Broke Off Due to Corrosion

RCS OXIDIZER MANIFOLD 5 ISOLATION VALVE	Presenter: Brian Werner
	Organization/Date: Orbiter/11-19-99

RCS Manifold 5 Isolation Valve Discussion: (Cont)

- Oxidizer corrosion also seen in electronics cavity and on outside of coil assembly
  - Corrosion expected when valve has an internal leak
  - Valve components external to the normal propellant flow path not designed to be corrosion resistant
- Further failure analysis showed a leak path through valve poppet stem
  - Use of visual magnifier required to see microscopic bubbles
  - Leak measured at 5.5×10^{-5} sccs He at 300 psi
  - Evidence of oxidizer found at leak site
- Failure analysis found no evidence of incipient mechanical damage
  - No cracks at sealing surfaces or elsewhere
  - No material loss (except for grains pulled out by polishing process)

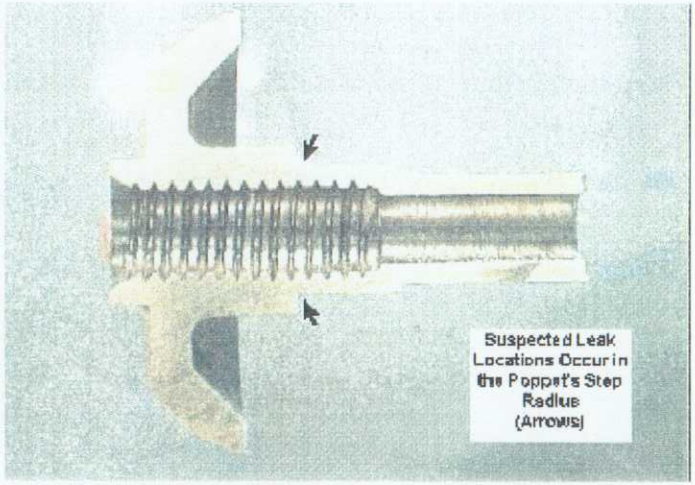
RCS OXIDIZER MANIFOLD 5 ISOLATION VALVE	Presenter: Brian Werner
	Organization/Date: Orbiter/11-19-99

RCS Manifold 5 Isolation Valve Discussion: (Cont)

- Metallurgical examination of failed poppet indicates leakage was due to intergranular attack
  - Slow leakage through degraded grain boundaries
  - No physical, "flowing" leak path present
    - No evidence of fractures or flaws that would allow a high ("free flowing") leak rate
    - Consistent with measured low leak rate
  - Attack appeared greatest along outer surface
    - Suggests condition was aggravated by cracked glass seal allowing atmospheric moisture intrusion into valve
- Some heat treatment of AM355 poppet material can result in "sensitized" grain boundaries
  - Less resistant to intergranular attack

RCS OXIDIZER MANIFOLD 5 ISOLATION VALVE

Presenter:
Brian Werner
Organization/Date:
Orbiter/11-19-99

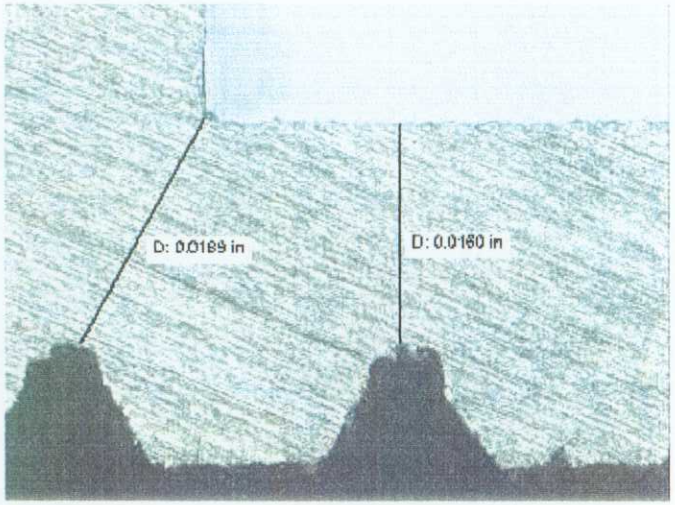


Cross Section of Poppet

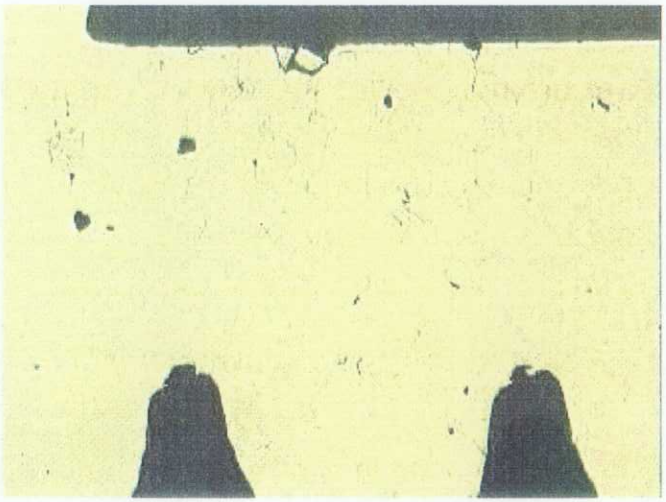
External Contamination on Poppet

RCS OXIDIZER MANIFOLD 5 ISOLATION VALVE

Presenter:
Brian Werner
Organization/Date:
Orbiter/11-19-99



Cross Section of Poppet



Poppet Grain Boundaries

RCS OXIDIZER MANIFOLD 5 ISOLATION VALVE	Presenter: Brian Werner
	Organization/Date: Orbiter/11-19-99

RCS Manifold 5 Isolation Valve Discussion: (Cont)

- Metallurgical analysis of additional AM355 samples performed
  - Poppet from oxidizer valve S/N 27 shows similar intergranular attack
    - Lesser degree than S/N 25
    - Exposed to oxidizer for 13 years
    - Was removed from failed valve at EVAD
  - Poppet from fuel valve S/N 18 shows no evidence of intergranular attack
    - Exposed to fuel for 17 years
    - Was installed in WSTF FRCS Fleet Leader Test Article
  - Analysis on vernier thruster seats showed no evidence of attack
    - Material not sensitized

RCS OXIDIZER MANIFOLD 5 ISOLATION VALVE	Presenter: Brian Werner
	Organization/Date: Orbiter/11-19-99

RCS Manifold 5 Isolation Valve Discussion: (Cont)

- Published data indicates that AM355 exhibits fair resistance to oxidizer and good resistance to fuel
  - Corrosion rate is extremely slow for oxidizer up to 100 deg F
  - Corrosion rate is slower with fuel
    - AM355 compatible with fuel up to 160 deg F
    - Nominal RCS propellant temperatures are 80 deg F

RCS OXIDIZER MANIFOLD 5 ISOLATION VALVE	Presenter: Brian Werner
	Organization/Date: Orbiter/11-19-99

RCS Manifold 5 Isolation Valve Discussion: (Cont)

- Most valve components external to the normal propellant flow path not designed to be corrosion resistant
  - Coil lead and magnet wires encapsulated with potting to resist corrosion
- VPI anomalies appear to be a good leading indicator of possible valve internal leakage
  - Interior of switch open to oxidizer vapor intrusion
    - Corrosion of switch will affect VPI
    - Switch spring mechanism material susceptible to corrosion from oxidizer
  - S/N 25 Valve continues to function 2 years after initial VPI anomaly

RCS OXIDIZER MANIFOLD 5 ISOLATION VALVE

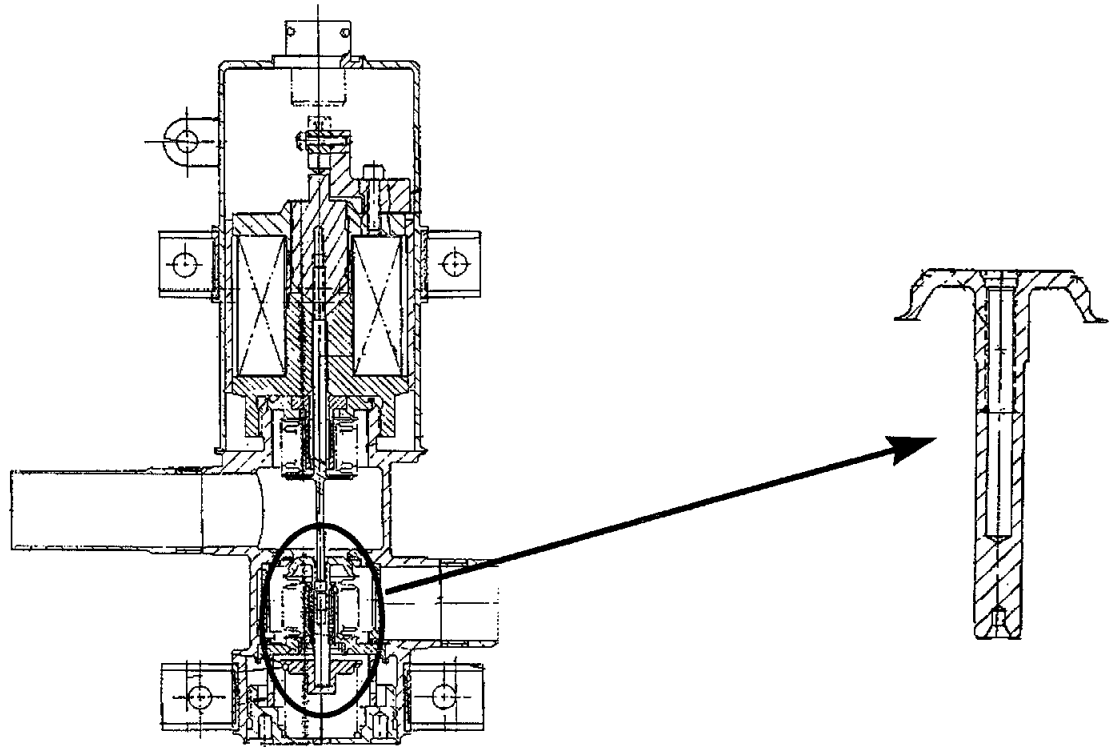
Presenter:
Brian Werner
Organization/Date:
Orbiter/11-19-99

OMS Vapor Isolation Valve Discussion:

- PR reported on LV506 on RP03 prior to STS-70 - valve indicated OPEN when commanded CLOSE
  - After repeated cycling, VPI anomaly reoccurred
  - Valve operation was nominal
  - Deferred one flight to OMDP
  - Troubleshooting in HMF included valve cycling and wire wiggling
  - Inspection of connector revealed slight corrosion on 4 connector pins
  - Corrosion was cleaned, all retests were nominal, PR closed
- During STS-103 flow, VPI anomaly occurred again
  - Troubleshooting could not repeat anomaly
  - Valve operation was nominal and problem has been documented as a UA and deferred to next flow
- May be indication of similar poppet leak

RCS OXIDIZER MANIFOLD 5 ISOLATION VALVE

Presenter:
Brian Werner
Organization/Date:
Orbiter/11-19-99



OMS Vapor Isolation Valve

OMS Vapor Isolation Valve Poppet

RCS OXIDIZER MANIFOLD 5 ISOLATION VALVE	Presenter: Brian Werner
	Organization/Date: Orbiter/11-19-99

OMS Vapor Isolation Valve Discussion: (Cont)

- Valve is primarily exposed to oxidizer vapor
  - Quad check valve minimizes oxidizer vapor migration
  - Limited exposure due to closed manual valve on ground which isolates propellant tank from He system
  - During any OMS burn or tank repressurization any ox vapor would be swept downstream of valve
- Corrosion rate much slower with vapor than liquid
- Coil lead and magnet wires encapsulated with potting
  - First indication of failure would most likely be in VPI
- Redundant valve/flow path to protect for failed closed condition

RCS OXIDIZER MANIFOLD 5 ISOLATION VALVE

Presenter:
Brian Werner
Organization/Date:
Orbiter/11-19-99

Failure Analysis and Data Review Conclusions:

- Slow leakage occurred through degraded grain boundaries (intergranular corrosion)
  - Condition possibly aggravated by connector glass seal failure
- No evidence of cracking or other flaw that could result in high leak rate
  - Intergranular attack will not propagate into larger leak
- Material is more resistant to fuel than oxidizer
- VPI anomalies appear to be a good leading indicator of possible valve internal leakage
  - Interior of switch open to oxidizer vapor intrusion
    - Corrosion of switch will affect VPI
  - RCS manifold 5 valve and OMS vapor isolation valve continue to function 2 years after initial VPI anomalies

RCS OXIDIZER MANIFOLD 5 ISOLATION VALVE

Presenter:
Brian Werner
Organization/Date:
Orbiter/11-19-99

Risk Assessment for Worst-Case Failure Scenarios of RCS Manifold 5 Valves:

- Internal leakage—oxidizer
  - No physical, "flowing" leak path present
  - No evidence of fractures or flaws that would allow a high ("free flowing") leak rate
    - Consistent with intergranular corrosion
    - Consistent with measured low leak rate
  - If internal leakage is present, leak rate would remain very small
  - Internal leakage may lead to corrosion of switch and/or coil
    - Corrosion of switch will only affect VPI
    - Coil lead and magnet wires encapsulated with potting to resist corrosion

RCS OXIDIZER MANIFOLD 5 ISOLATION VALVE

Presenter:
Brian Werner
Organization/Date:
Orbiter/11-19-99

Risk Assessment for Worst-Case Failure Scenarios of RCS Manifold 5 Valves: (Cont)

- Internal leak—fuel
  - Fuel valve (S/N 18) showed no intergranular attack (17 year exposure)
    - Material was sensitized
  - Compatibility reports indicate insignificant corrosion with fuel at temperatures less than 160 deg F
  - Valve temperatures much less than 160 deg F
  - Location of valve is thermally controlled
    - Nominal temperature is 80 deg F
  - No concern for fuel leakage
- External leak— oxidizer
  - All OV-103 manifold 5 isolation valves have been inspected visually and with sniff checks and no anomalies were noted
  - External leakage requires glass seal to be cracked and vapor leakage through mating connector
    - First effect would be corrosion of connector pins
    - Inconsequential amount of vapor in pod may cause minor thermal blanket deterioration

RCS OXIDIZER MANIFOLD 5 ISOLATION VALVE

Presenter:
Brian Werner
Organization/Date:
Orbiter/11-19-99

Risk Assessment for Worst-Case Failure Scenarios of RCS Manifold 5 Valves: (Cont)

- Intermittent VPI anomaly
  - Change in VPI would cause onboard alarm and downmode from vernier control to free drift
  - Crew keystrokes required to reset
  - Only instance of uncommanded valve position changes occurred during STS-85 on S/N 25
  - Similar occurrence is manageable in flight
- Poppet integrity due to corrosion
  - No evidence of incipient mechanical damage
  - Sealing surface area is 3 times thicker than point of leakage
  - Very sharp radius at leak location vs. smooth curves at poppet head
  - Valve seat is Teflon

RCS OXIDIZER MANIFOLD 5 ISOLATION VALVE	Presenter: Brian Werner
	Organization/Date: Orbiter/11-19-99

Risk Assessment for Worst-Case Failure Scenarios of RCS Manifold 5 Valves: (Cont)

- Loose grains flowing in propellant flow path
  - Intergranular corrosion did not cause grains to come loose
    - Loose grains due to polishing of poppet cross-sections
  - Loose grains inside bellows cavity are contained by Teflon sleeves
  - 24 Micron inlet filter on vernier thruster will catch large particles in flow path
  - Smaller particles should not affect vernier valve

RCS OXIDIZER MANIFOLD 5 ISOLATION VALVE	Presenter: Brian Werner
	Organization/Date: Orbiter/11-19-99

Risk Assessment for Worst-Case Failure Scenarios of RCS Manifold 5 Valves: (Cont)

- Failed open valve (Crit 1R/3)
  - Manifold 5 valves remain open entire mission unless there is a vernier thruster leak
    - One case in flight history - STS-28
  - Upstream valve available to isolate system
  - Loss of all thrusters on RCS manifolds 3/4/5 if a vernier thruster leaks and the manifold 5 valve fails open
- Failed close valve (Crit 2/2)
  - Manifold 5 valves remain open entire mission unless there is a vernier thruster leak
  - Loss of RCS vernier thruster on affected manifold if manifold 5 valve fails closed
    - No mission impact for STS-103

RCS OXIDIZER MANIFOLD 5 ISOLATION VALVE

Presenter:
Brian Werner
Organization/Date:
Orbiter/11-19-99

Risk Assessment for Worst-Case Failure Scenarios of OMS Vapor Isolation Valves:

- Internal leakage—oxidizer
  - Vapor isolation valve much less susceptible to corrosion due to limited exposure to oxidizer vapor
  - Corrosion rate much slower with vapor than liquid
  - If internal leakage is present, leak rate would remain extremely small
    - Intergranular attack will not propagate into larger leak
  - Internal leakage may lead to corrosion of switch and/or coil
    - Corrosion of switch will only affect VPI
    - Coil lead and magnet wires encapsulated with potting to resist corrosion

RCS OXIDIZER MANIFOLD 5 ISOLATION VALVE	Presenter: Brian Werner
	Organization/Date: Orbiter/11-19-99

Risk Assessment for Worst-Case Failure Scenarios of OMS Vapor Isolation Valves: (Cont)

- External leak—oxidizer
  - No evidence of gross leakage detected in OMS pod static air samples
  - External leak requires a second failure of connector glass seal
  - Any leak would be much much smaller than very small leak seen on RCS manifold 5 valve because OMS vapor Isolation valve is primarily exposed to vapor
    - First effect would be corrosion of connector pins
    - Inconsequential amount of vapor in pod may cause minor thermal blanket deterioration

RCS OXIDIZER MANIFOLD 5 ISOLATION VALVE

Presenter:
Brian Werner
Organization/Date:
Orbiter/11-19-99

Risk Assessment for Worst-Case Failure Scenarios of OMS Vapor Isolation Valves: (Cont)

- Failed close valve (Crit 1R/2)
  - Failed closed valve eliminates redundancy in flow path
    - Loss of ability to pressurize OMS oxidizer tank if both vapor isolation valves fail closed
  - Loss of OMS tank pressurization capability higher than normal risk for STS-103 mission
    - Attitude of HST requires use of all OMS propellant for de-orbit
    - Same risk due to failure of any OMS He system component
  - Valve failure assumed if VPI anomaly (open/close) occurs
    - Assume worst case failed close since unable to determine valve function without VPI
  - Propellant utilization would be per existing flight rules
    - Only propellant from affected tank would be used to maximize ullage for blowdown capability
    - Unbalanced deorbit burn would be performed per flight rules
      - Feed 2 OMEs from one pod until quantities are balanced then switch to straight feed

RCS OXIDIZER MANIFOLD 5 ISOLATION VALVE

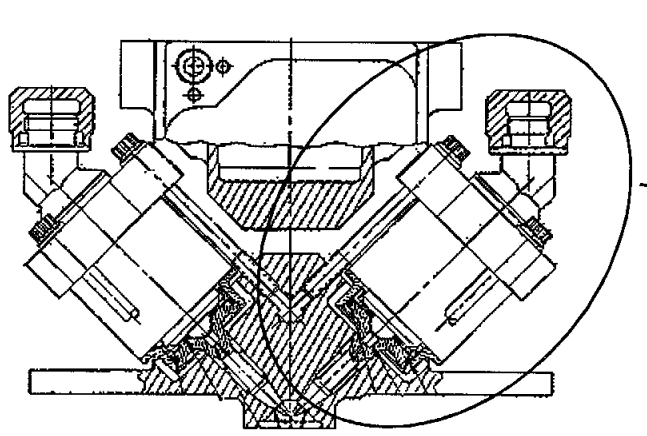
Presenter:
Brian Werner
Organization/Date:
Orbiter/11-19-99

Risk Assessment for Worst-Case Failure Scenarios of RCS Vernier Thruster Valves:

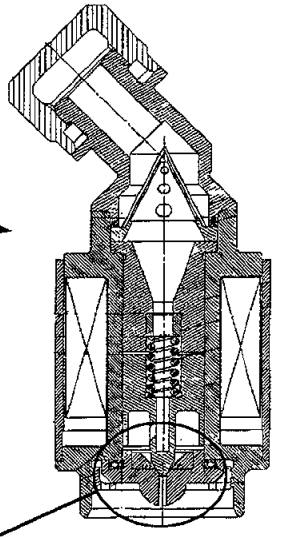
- RCS vernier thrusters seat and retainer are AM355
- Very limited exposure of valve seat to propellant during non-firing periods
- No concern for grain boundary leakage through retainer
  - Retainer welded to valve seat to hold Teflon seal in place
- Similar propellant leak through grain boundaries would be undetectable in flight
  - 5×10^{-5} sccs is significantly less than valve allowable leak rates (OMRSD - 350 scch)
- No operational effect on thruster or valve if leak path developed
  - Leak would go overboard and be undetectable
- Analysis on thruster seats showed no evidence of attack
  - Material not sensitized

RCS OXIDIZER MANIFOLD 5 ISOLATION VALVE

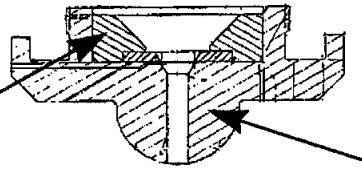
Presenter:
Brian Werner
Organization/Date:
Orbiter/11-19-99



RCS Vernier Thruster Injector Assy



RCS Vernier Thruster Valve



RCS Vernier Thruster Valve Seat Assy

RCS OXIDIZER MANIFOLD 5 ISOLATION VALVE

Presenter:
Brian Werner
Organization/Date:
Orbiter/11-19-99

Risk Assessment for Worst-Case Failure Scenarios Summary:

Component	Manifold 5 Valve Poppet	Vapor Isolation Valve Poppet	Vernier Thruster Seat
Propellant Exposure	Always	Primarily vapor	Limited
First Effect of Oxid Corrosion	VPI anomaly	VPI anomaly	Insignificant valve leakage
Worst Operational Effect	Crew procedures in-place for transient VPI - valve failure contingent upon vernier failure	Assume failed valve - use prop per Flight Rules	No effect

RCS OXIDIZER MANIFOLD 5 ISOLATION VALVE

Presenter:
Brian Werner
Organization/Date:
Orbiter/11-19-99

Acceptable for STS-103 Flight:

- Failed ox manifold isolation valve has been removed and replaced
  - Replacement valve has passed OMRSD retest requirements
  - All OV-103 manifold 5 isolation valves have been inspected visually and with sniff checks and no anomalies were noted
    - External leakage through the valve is an inspectable condition
- Intergranular corrosion with AM355 is a very slow process
  - Valve exposed to oxidizer for 15 years
- Oxidizer leakage into valve first manifests itself as VPI problem
  - Initial indication of problem occurred two years ago as intermittent VPI
  - No effect on valve function
- Subsystem redundancy and flight rules exist for worst-case failed open/close manifold 5 valve and vapor isolation valve
- No concern with intergranular corrosion in the fuel manifold 5 valve
- No concern with RCS vernier thruster valve

EXTERNAL TANK GO2 2 INCH DISCONNECT FAILURE ON ET-106

Presenter: Tim Reith
Organization/Date: Orbiter/11-19-99

Observations:

- Following LO2 tank pressurization operations for ET-106 at MAF, the GO2 2 inch disconnect failed to close
- Inspection of the failed hardware showed missing chrome plating from the end of the poppet stem

Concern:

- Relationship of failed unit to the four 2 inch disconnects installed for STS-103 (Orbiter and ET GO2 and GH2)

Current Status:

- Failed disconnect on ET-106 has been replaced
- STS-103 units have satisfied all OMRS functional and inspection checkout
  - Most recent inspection was borescoping performed during Orbiter/ET mate
- Analyses performed to address potential for chrome particle impact ignition in the GO2 system and ET/Orbiter recontact due to venting

EXTERNAL TANK GO2 2 INCH DISCONNECT FAILURE ON ET-106

Presenter:
Tim Reith

Organization/Date:
Orbiter/11-19-99

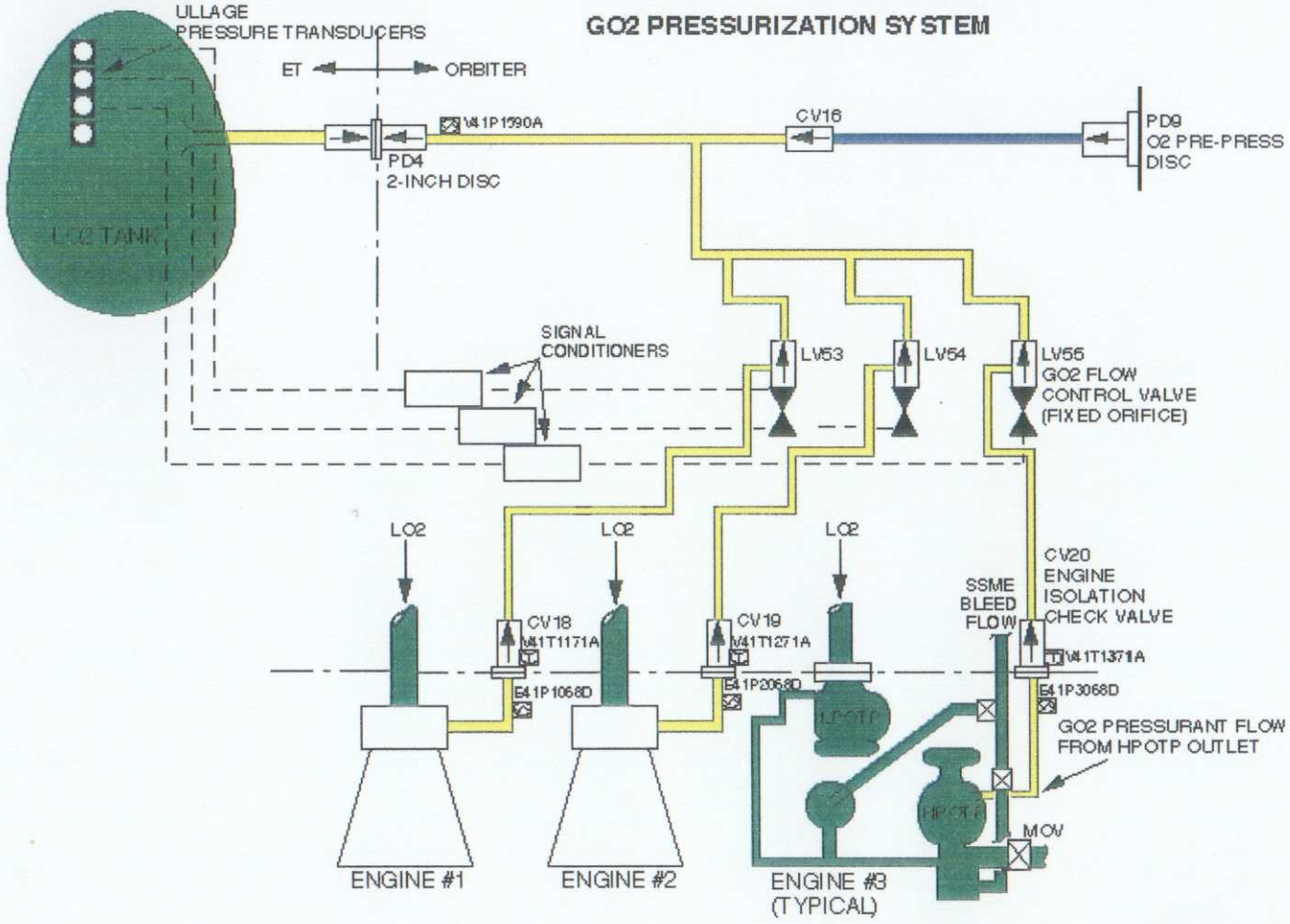
Acceptable For STS-103 Flight:

- ET/Orbiter recontact analysis for a failed open GO2 or GH2 2 inch disconnect showed positive margins
- Build information for S/N 1222 and the STS-103 disconnects show significantly different manufacturing and processing histories
  - STS-103 hardware was not reworked nor was it removed from its respective umbilical once it was installed
- Chrome plating processes on S/N 1222 and the STS-103 disconnects were performed by different vendors
- ET & Orbiter hardware for STS-103 have successfully passed all OMRS requirements

EXTERNAL TANK GO2 2 INCH DISCONNECT FAILURE ON ET-106

Presenter:
Tim Reith

Organization/Date:
Orbiter/11-19-99



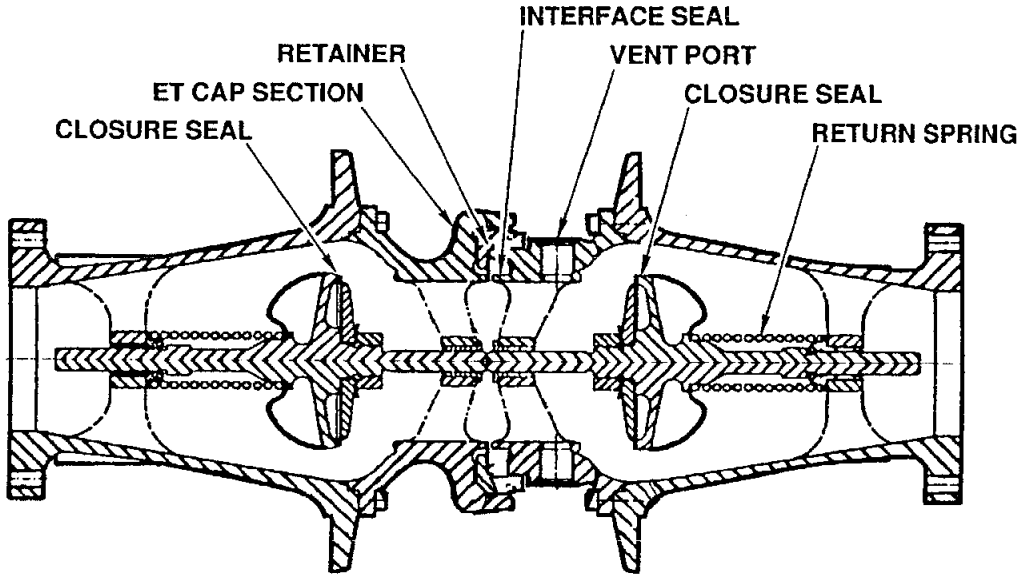
BOEING

103fpmps.ppt 11/17/99 7:30am

EXTERNAL TANK GO2 2 INCH DISCONNECT FAILURE ON ET-106

Presenter:
Tim Reith

Organization/Date:
Orbiter/11-19-99

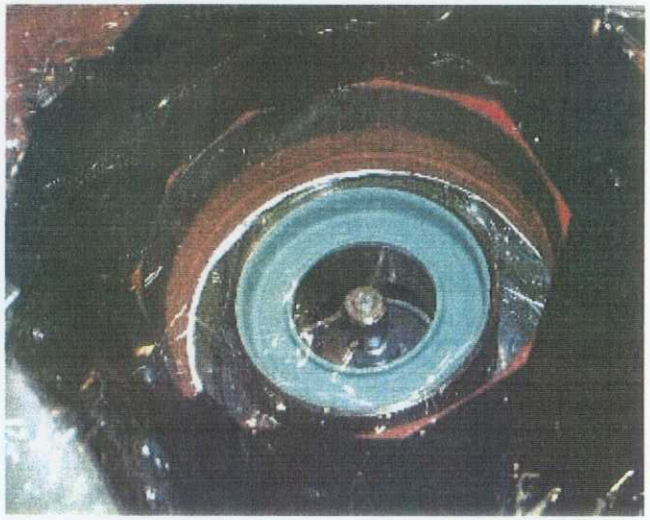


MPS GO2/GH2 PRESSURIZATION DISCONNECT
MC284-0391-0001 (TYPE I) - ORBITER
MC284-0391-0002 (TYPEII) - ET

EXTERNAL TANK GO2 2 INCH DISCONNECT FAILURE ON ET-106

Presenter:
Tim Reith

Organization/Date:
Orbiter/11-19-99



Failed open disconnect

Closed disconnect showing poppet stem damage

ET-106 GO2 2 Inch Disconnect

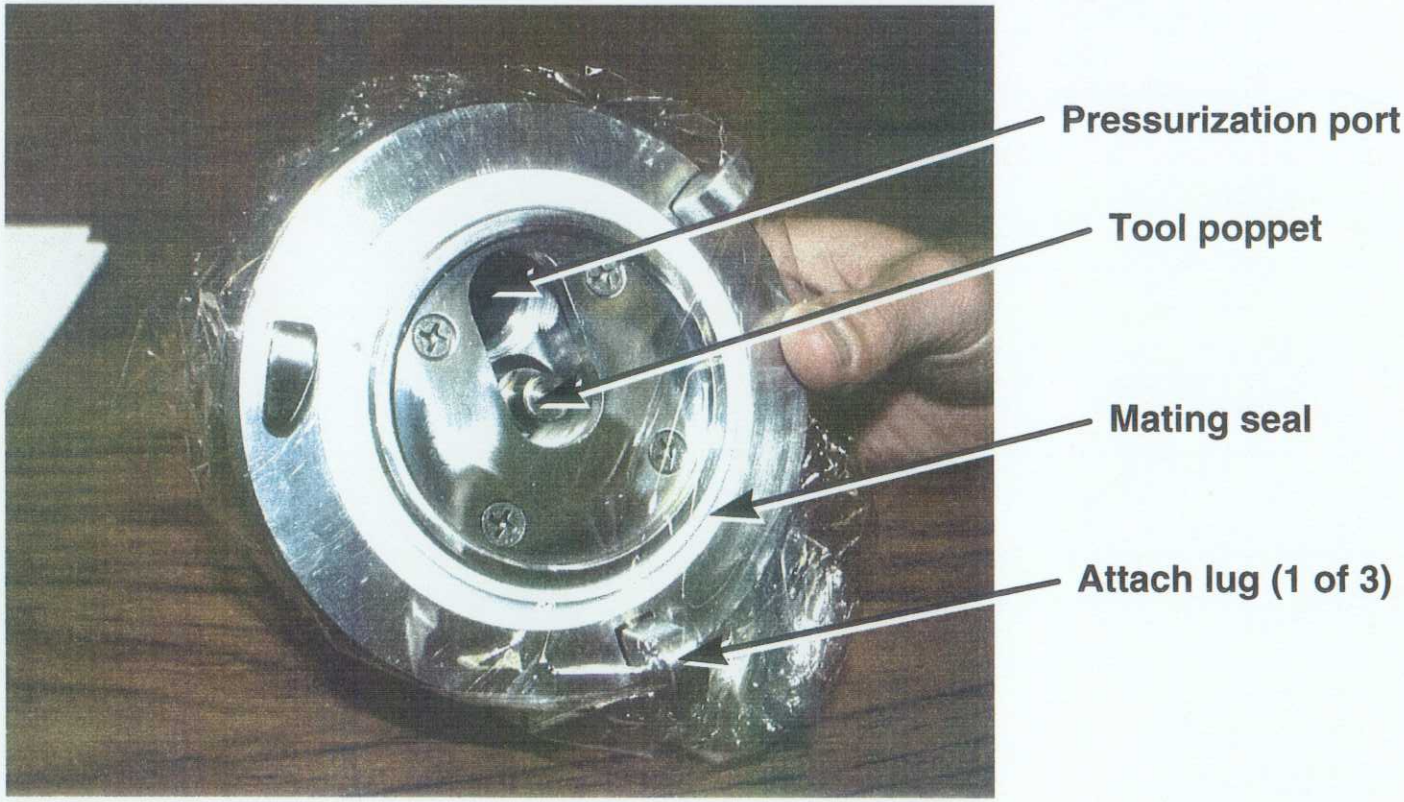
EXTERNAL TANK GO2 2 INCH DISCONNECT FAILURE ON ET-106

Presenter:
Tim Reith

Organization/Date:
Orbiter/11-19-99

Discussion:

- Pressurization of ET LO2 tank is accomplished via a GSE tool attached to the GO2 2 inch disconnect



EXTERNAL TANK GO2 2 INCH DISCONNECT FAILURE ON ET-106	Presenter: Tim Reith
	Organization/Date: Orbiter/11-19-99

Discussion: (Cont)

- Following discovery of disconnect failing to close, a team was sent to MAF to replace disconnect
  - During removal, poppet snapped closed
  - Missing material noted at two areas on poppet stem
    - Largest area approximately 0.08" x 0.04"
    - Traverses from end of stem and across chamfer
  - Piece of debris removed from disconnect determined to be chrome with minor amount of 316 CRES
    - Maximum dimension - 0.051"
    - Maximum thickness - 0.006"
- Poppet is a single piece casting of 316 CRES, solution heat treated
  - Stem is chrome plated - drawing callout is 0.0003" to 0.0005" thick

EXTERNAL TANK GO2 2 INCH DISCONNECT FAILURE ON ET-106

Presenter:
Tim Reith
Organization/Date:
Orbiter/11-19-99

History of Failed Disconnect - S/N 1222:

- Poppet installed in S/N 1222 is from lot of 4
  - Poppet underwent a significant number of reworks due to manufacturing and plating issues
    - Most likely reason for excessive chrome plating
- 1222 ATP completed 7/97
- 1222 Installed in umbilical End Item 101 at Palmdale 8/97
- 1222 ET side flange reworked 10/97
- 1222 Removed from End Item 101 due to 17" disconnect torsion bar issue 3/98
- 1222 Reinstalled into End Item 101 2/99
- End Item 101 shipped to MAF 5/99

EXTERNAL TANK GO2 2 INCH DISCONNECT FAILURE ON ET-106	Presenter: Tim Reith
	Organization/Date: Orbiter/11-19-99

History of Failed Disconnect - S/N 1222: (Cont)

- After removal from umbilical at MAF, 1222 sent to vendor for failure analysis
  - Failed internal leak check - blowing leak
  - Binding exhibited during Instron test at ~ 0.4" of stroke
  - Poppet removed from disconnect and found to be bent
    - Concentricity of 0.021" - s/b less than 0.001"
    - Perpendicularity of 0.004" - s/b less than 0.001"
    - Cause of bent poppet stem unknown - possible mechanical impact
- No discrepancies noted during inspection of GSE tool
  - Tool stroke verified to be within requirements
    - Measured 0.237" vs 0.115" - 0.386" requirement
- Loss of chrome plating believed to be due to multiple factors
  - Possibly lost during event which bent poppet
  - Bent poppet which would allow point load contact with tool
  - Excessive chrome plating thickness due to multiple reworks

EXTERNAL TANK GO2 2 INCH DISCONNECT FAILURE ON ET-106

Presenter:
Tim Reith

Organization/Date:
Orbiter/11-19-99

History of Disconnects Installed for STS-103:

- Orbiter units have been installed since 1989
  - 18 Flights for GH2 disconnect
  - 17 Flights for GO2 disconnect
- ET GO2
  - Manufactured in 1991
  - Chrome plated by U.S. Chrome
  - No discrepancies recorded
- ET GH2
  - Manufactured in 1986
  - Chrome plated by Modern Plating Co.
  - No discrepancies recorded

EXTERNAL TANK GO2 2 INCH DISCONNECT FAILURE ON ET-106

Presenter: Tim Reith
Organization/Date: Orbiter/11-19-99

Acceptability of STS-103 Flight Hardware:

- Hardware installed on STS-103 is unrelated to S/N1222
  - 1222 Data pack shows a significant number of discrepancies reworked prior to arrival at MAF
    - Both during manufacture and during umbilical assembly
- Build paper for ET disconnects for STS-103 does not show any discrepancies or reworks
- STS-103 disconnects have passed all OMRS requirements
  - Leak checks, actuations, alignment during umbilical mate
- STS-103 disconnects chrome plating verified to be intact via borescope inspection performed during umbilical mate
- No leakage noted from ET disconnects prior to umbilical mate
  - Multiple poppet actuations and long dwell periods where poppet would have to seal

EXTERNAL TANK GO2 2 INCH DISCONNECT FAILURE ON ET-106	Presenter: Tim Reith
	Organization/Date: Orbiter/11-19-99

Risk Analysis:

- If S/N 1222 failure conditions existed on flight unit:
  - Failed open disconnect - GO2 or GH2
    - ET/Orbiter recontact
      - Nominal, TAL, and RTLS cases show margin
    - ET reentry footprint
      - No concern - tumble valve removed 5 years ago
    - Leakage into aft compartment
      - ET - torturous path over very short time period
      - Orbiter - system would vent down prior to ET door closure
    - Helium loss during abort entry
      - Repress reg would lockup based on 17 inch LO2 manifold pressure and terminate flow to 2 inch system

EXTERNAL TANK GO2 2 INCH DISCONNECT FAILURE ON ET-106	Presenter: Tim Reith
	Organization/Date: Orbiter/11-19-99

Risk Analysis: (Cont)

- If S/N 1222 failure conditions existed on flight unit: (cont)
  - Particle impact ignition in GO2 system for loss of chrome plating
    - Orbiter - Ignition is not a concern in the GO2 system based on materials and velocities involved
    - ET - Velocity of gas internal to diffuser exceeds experience database
      - Impact analysis inconclusive to determine if sufficient energy exists to ignite diffuser screen

Orbiter and ET hardware on STS-103 are not at risk for loss of chrome plating

EXTERNAL TANK GO2 2 INCH DISCONNECT FAILURE ON ET-106	Presenter: Tim Reith
	Organization/Date: Orbiter/11-19-99

Acceptable For STS-103 Flight:

- ET/Orbiter recontact analysis showed positive margins
- Build information for S/N 1222 and the STS-103 disconnects show significantly different manufacturing and processing histories
  - STS-103 hardware was not reworked nor was it removed from its respective umbilical once it was installed
- Chrome plating processes on S/N 1222 and the STS-103 disconnects were performed by different vendors
- ET & Orbiter hardware for STS-103 have successfully passed all OMRS requirements

	Presenter: Tom Peterson
	Organization/Date: Flight Software/11-19-99

SOFTWARE

STS-103 SOFTWARE READINESS

Presenter:
Tom Peterson
Organization/Date:
Flight Software/11-19-99

Sixth and Last Scheduled Flight of OI-26B Software

One New Software Patch in work for STS-103

- PASS CR 92467 - STS103 HST Command Patch
  - 4 HW data patch to provide crew ITEM entry capability to reset both Pointing and Safemode Electronics Assembly computers following HST grapple
  - Emulates existing uplink command to protect for loss of comm
  - Program direction to proceed received on 11-17-99
  - Patch to be generated, verified and released by 11-24-99
  - SAIL testing scheduled for 11-29-99

With Completion of Open Work and Closure of CoFR Exception, Flight Software Is Ready to Fly

	Presenter:
	Organization/Date: Orbiter-GFE/11-19-99

GFE

STS-103 MAGR GPS 15 Alternate SV "Tilt" Issue	EV15/S. V. Murray
	November 12, 1999

SAIL testing of MAGR f/w Link 004 Identified a new cause of Software Initiated Autonomous Resets ("Tilts").

- "Tilts" will occur when more than 15 SV's are on the Alternate List and the peripheral channel is attempting loss of lock recovery.

  Alternate List = Visible Satellites - Satellites being tracked
  Can track 0-4 satellites
  16-20 visible satellites theoretically required
  Actual tilts in SAIL all had 20 satellites visible

- This issue was identified before STS-96 and briefed at the STS-96 L-2.
  No "Tilts" occurred.

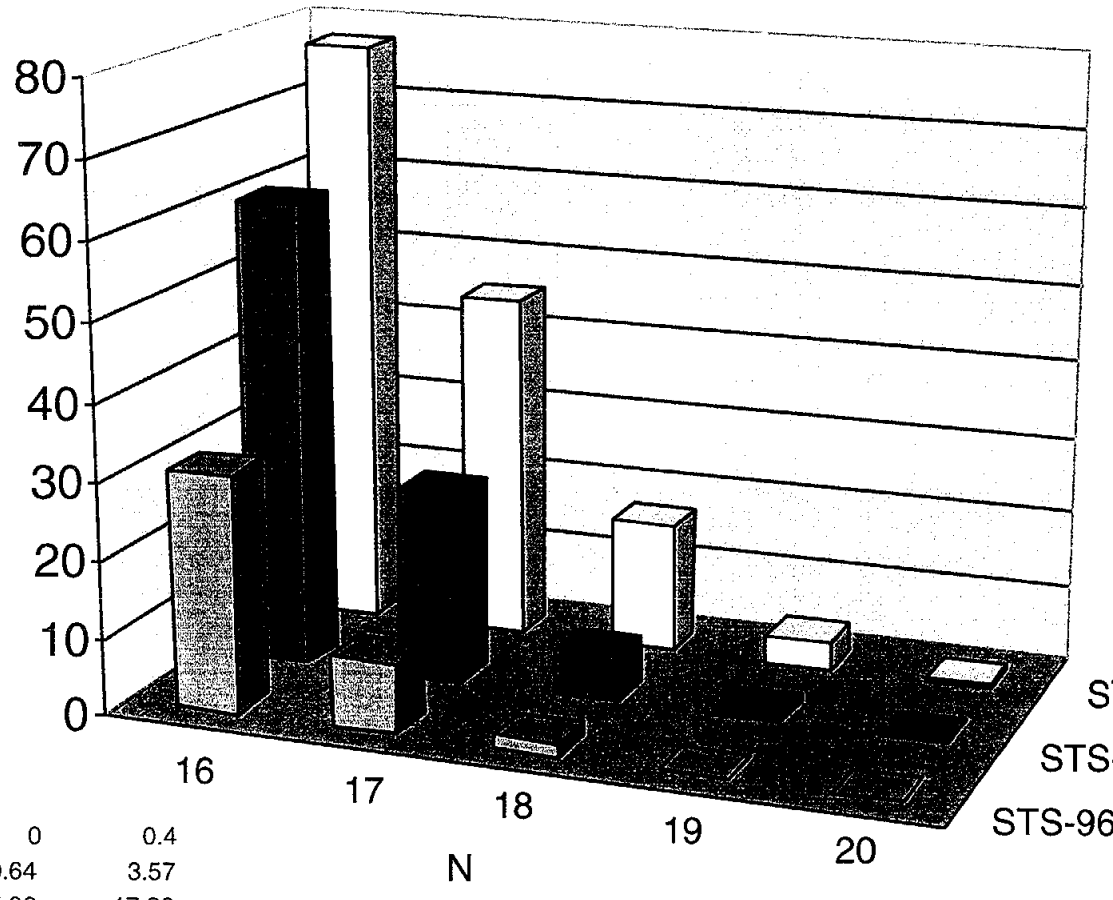
STS-103 will be more vulnerable to the 15 Alternate SV "Tilt" Condition.

- STS-103 will have more satellites in view than STS-96.

  The HST Repair Mission flies at a higher altitude.
  A new GPS SV may be on line (Launched Oct 8).

STS-103 MAGR GPS 15 Alternate SV "Tilt" Issue	EV15/S. V. Murray
	November 12, 1999

Percent of Time the # of Visible SV's >= N



20	0	0	0.4
19	0.12	0.64	3.57
18	1.59	5.96	17.26
17	9.17	24.84	45.41
16	30.92	60.7	77.45

Preliminary Analysis based on a "guess" of the final positioning of the new GPS satellite. HST orbit used. Ascent/Entry/Rend effects not considered

.4% = 57.6 minutes exposure to 20 SV's

STS-103 MAGR GPS 15 Alternate SV "Tilt" Issue	EV15/S. V. Murray
	November 12, 1999

Summary:

"Tilts" are much more probable for STS-103 than for STS-96

They are not a threat to shuttle safety or operations.

Shuttle Flight Software was "bullet proofed" against tilts after STS-91.
They often occurred (~ every 2 days) on STS-95 & 88 with no harmful effects.
(These tilts were caused by a different condition which has been corrected)
MAGR usually automatically recovers within 2-4 minutes.
Less likely to occur at low altitudes during entry.
GPS is not being used for critical operations.

The cause is understood and will be corrected in the next firmware link.

EMERGENCY O2 SYSTEM ACTIVATION FORCES	S. Walker
	JSC Engineering/ 11-19-99

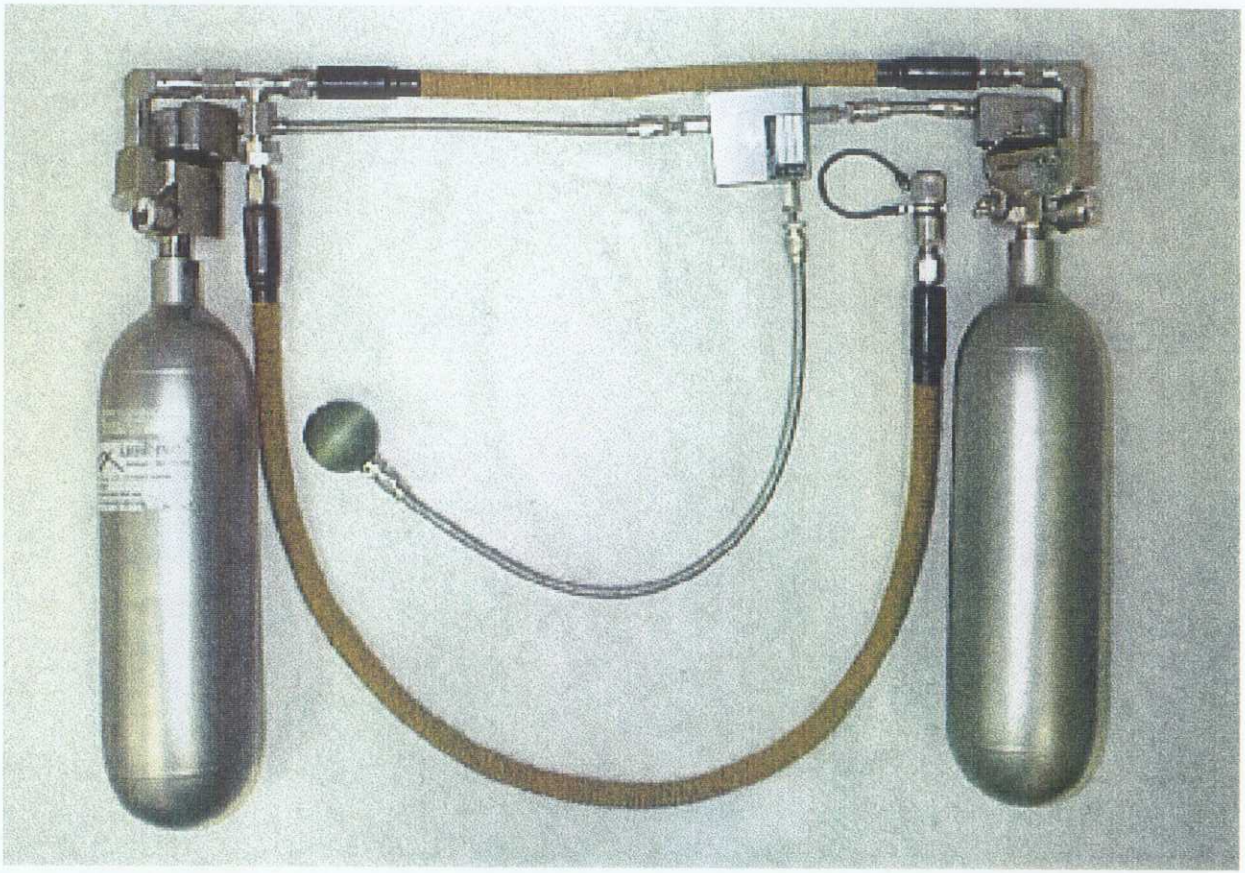
- **Issue**
  - Actuation of Crew-worn Emergency O2 System (EOS) requires forces higher than can be actuated in suited conditions
    - STS-93 TCDT 3 crew unable to activate EOS
    - Previous occurrences during crew training, TCDT
- **Concerns**
  - In emergency conditions crew needs to be able to easily activate O2 system
  - Do not want system inadvertently actuated

Stephanie Walker/EC5/281-483-9140

EMERGENCY O2 SYSTEM ACTIVATION FORCES

S. Walker

JSC Engineering/ 11-19-99



ORB-GFE 6

Stephanie Walker/EC5/281-483-9140

23

EMERGENCY O2 SYSTEM ACTIVATION FORCES

S. Walker

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EOS BOTTLE

GREEN APPLE

ORB-GFE 7

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EMERGENCY O2 SYSTEM ACTIVATION FORCES	S. Walker
	JSC Engineering/ 11-19-99

- **Current EOS pull force specification**
  - EOS shall activate with a pull force of 25 $\pm$ 10 lb
  - EOS testing to specification done on flat tabletop, pulling cable straight
  - Actual use, cable routed around the body, not a straight pull
  - EOS former military system, specifications never check to suited capability.

Stephanie Walker/EC5/281-483-9140

EMERGENCY O2 SYSTEM ACTIVATION FORCES	S. Walker
	JSC Engineering/ 11-19-99

- **Actions taken**
  - Investigation of STS-93 units found no specific discrepancies
  - Testing of suited crew capabilities indicates specification should be 15-20 lb in the operational condition
  - EOS vendor redesigning gear ratio to achieve lower activation forces
  - NASA investigating change in activation knob & location due to reach issues when pressurized

Stephanie Walker/EC5/281-483-9140

EMERGENCY O2 SYSTEM ACTIVATION FORCES	S. Walker
	JSC Engineering/ 11-19-99

- **Future work**
  - Testing of alternate knobs, locations Nov/Dec
  - Prototype to be delivered Jan 00.
  - Test prototype with wide range of crew sizes for activation forces, reach
  - New design for flight: goal STS-101

Stephanie Walker/EC5/281-483-9140

EMERGENCY O2 SYSTEM ACTIVATION FORCES	S. Walker
	JSC Engineering/ 11-19-99

- **STS-103 Acceptable**
  - 103 crew tested EOS access with pressurized suits during training 10/14/99 - no issues
  - Flight PBAs reviewed, allocated to 99 and 103 crews to give lowest pull force units available
    - Note: 2 lowest units allocated to 99 crew
    - Units within 25$\pm$ 10 lb pull force tabletop. Installed configuration pull forces from 45-80 lb.
  - Crewmembers with 2 highest force units tested in lab, no issues with activation unsuited

Stephanie Walker/EC5/281-483-9140

EMERGENCY O2 SYSTEM ACTIVATION FORCES	S. Walker
	JSC Engineering/ 11-19-99

- At TCDT, all Crewmembers activated their flight EOS's with no issues. Therefore there are no issues for STS-103 with EOS activation

Stephanie Walker/EC5/281-483-9140

AGENDA

Presenter:	
George Davis	
Organization/Date:	
FCE/EVA	11-19-99

- **Mission Requirements**
- **Open Work Schedule**

STS-103 MISSION REQUIREMENTS

Presenter:
George Davis
Organization/Date:
FCE/EVA 11-19-99

- **Except for open work, all known mission requirements identified by the documents below have been met,**
  - **CCCD: SGD32104426-301, Revision C05, November 12, 1999**
  - **MECSLSI: V072-200180-Rev E01, October 18, 1999**
  - **ESEL CCBD: H0664R6: RN99-04, November 8, 1999**
  - **Photo/TV requirements stowage document: SP-SH-2001-103, Revision A, November 2, 1999**

STS-103 MISSION REQUIREMENTS

Presenter:
George Davis
Organization/Date:
FCE/EVA 11-19-99

Event	Schedule
OMI V1103.02 Support (EMU installation and test)	November 18, 1999
Locker Packing and Close-out (Houston and KSC)	Thru November 29, 1999
Crew Food Service (JSC and KSC)	November 29 thru December 6,1999
Crew Suiting (at KSC)	December 6, 1999

FCE/EVA IS READY FOR FLIGHT

	Presenter:
	Organization/Date: Orbiter/11-19-99

FLIGHT READINESS STATEMENT

SPACE SHUTTLE VEHICLE ENGINEERING OFFICE

STS-103 (OV-103) ☐ ORR ☒ FRR ☐ Prelaunch MMT

Pending completion of scheduled open work, the orbiter vehicle, support hardware, flight crew equipment, and software are certified and ready to support. For United Space Alliance accountable functions, insight, audit, and surveillance activities have been reviewed, and there are no constraints to flight.

ORBITER / FLIGHT SOFTWARE / FLIGHT CREW EQUIPMENT

D. A. Hamilton 11/19/99
D. A. Hamilton, Manager, Shuttle Engineering Office

R. V. Anderson 11/10/99
R. V. Anderson, Manager, Flight Crew Equipment Management Office

D. E. Stamper 11/10/1999
D. E. Stamper, TMR, Software

J. P. Mulholland
J. P. Mulholland, TMR, Orbiter and Flight Crew Equipment

REMOTE MANIPULATOR SYSTEM / SPACE VISION SYSTEM

C. J. Woodland For C. J. Woodland
C. J. Woodland, Program Manager, SRMS
MacDonald Dettwiler and Advanced Robotics Limited

L. Beach
L. Beach, Program Manager, SVS
NEPTEC

J. H. Newman
J. H. Newman, Manager, RMS Integration Office

FERRY FLIGHT PLANNING

G. E. Dawson 11/5/99
G. E. Dawson, Ferry Flight Manager

R. R. Roe Jr. 11/9/99
Ralph R. Roe, Manager
Space Shuttle Vehicle Engineering

ORB-FRS 2

USA SSVEO Functions

STS-103 (OV-103) FLIGHT READINESS STATEMENT

☐ ORR ☒ FRR ☐ Prelaunch MMT

PENDING COMPLETION OF SCHEDULED OPEN WORK, THE ORBITER VEHICLE, SUPPORT HARDWARE, FLIGHT CREW EQUIPMENT, AND SOFTWARE ARE CERTIFIED AND READY TO SUPPORT.

ORBITER / FLIGHT SOFTWARE

11-10-99

G. A. Ray, Program Director, Orbiter
Reusable Space Systems
Boeing North American

F. C. Littleton, Associate Program Manager
Orbiter Element
United Space Alliance

11-9-1999

T. F. Peterson, Associate Program Manager
Flight Software Element
United Space Alliance

FLIGHT CREW EQUIPMENT

11.10.99

G. W. Davis, FCE/EVA Associate Program Manager
United Space Alliance

ORB-FRS 3

	Presenter:
	Organization/Date: Orbiter/11-19-99

BACKUP INFORMATION

	Presenter:
	Organization/Date: Orbiter/11-19-99

PREVIOUS FLIGHT ANOMALIES BACKUP

PREVIOUS IN-FLIGHT ANOMALIES

Presenter:

Organization/Date:
Orbiter/11-19-99

STS-93 In-Flight Anomalies, Previous Space Shuttle Mission

- 1 Problem identified
  - Details presented on following pages

STS-96 In-Flight Anomalies, Previous OV-103 Mission

- 5 Problems identified
  - Details presented on following pages

All Anomalies and Funnies Have Been Reviewed and None Constrain STS-103 Rollout

	Presenter:
	Organization/Date: Orbiter/11-19-99

STS-93 IN-FLIGHT ANOMALIES BACKUP

PREVIOUS SPACE SHUTTLE MISSION OV-102 STS-93 IN-FLIGHT ANOMALIES	Presenter:
	Organization/Date: Orbiter/11-19-99

1 Problem Under Evaluation:

- STS-93-V-01: AC1 Phase A short — Special Topic
  - Approximately 5 seconds into the STS-93 mission, a momentary short on AC1 phase "A" was detected
    - A current spike in excess of 20 amps was observed on AC1 phase "A" for approximately 500 milliseconds
    - The SSME-1 controller DCU-A and SSME-3 controller DCU-B failed
  - All Orbiter systems which were powered by AC1 at the time of the short reacted to the under-voltage condition as expected
    - Recovered following the short
    - Continued to function nominally for the remainder of the mission
  - OV-103 wiring has been inspected
    - All anomalous conditions have been noted and repaired
      - Retest requirements have been defined and are currently in work

	Presenter:
	Organization/Date: Orbiter/11-19-99

STS-96 IN-FLIGHT ANOMALIES BACKUP

PREVIOUS SPACE SHUTTLE MISSION OV-103 STS-96 IN-FLIGHT ANOMALIES	Presenter:
	Organization/Date: Orbiter/11-19-99

5 Problems Have Been Identified As In-Flight Anomalies:

- STS-96-V-01: F4R Thruster failed leak
  - RCS thruster F4R (S/N 653) was deselected by the Redundancy Management (RM) as failed leak when the fuel injector temperature dropped below 20°F
  - Temperature immediately returned to normal
  - Thruster was reselected and placed in second priority, but was not required for the remainder of the mission
  - Thruster was deselected prior to RCS hot-fire and both thrusters on FRCS manifold 4 have been replaced
  - Primary thrusters have multiple redundancy (Crit 1R3) for all nominal mission phases

PREVIOUS SPACE SHUTTLE MISSION OV-103 STS-96 IN-FLIGHT ANOMALIES	Presenter:
	Organization/Date: Orbiter/11-19-99

5 Problems Have Been Identified As In-Flight Anomalies: (Cont)

- STS-96-V-02: Right OMS engine ball valve sluggish operation
  - During STS-96 OMS assist burn, the right OMS engine (S/N 114) bipropellant valve #2 had a slow opening time
    - Opening time was within spec on subsequent burns during mission
  - Opening time was at the File IX allowable limit of 0.8 second
  - Probable cause is binding in bipropellant valve due to propellant permeation
    - Long engine wet time and downtime period between flights may contribute to this
  - Failure did not affect engine performance
  - Engine has been removed and replaced
    - TT&E is currently in work at WSTF
  - OMS engines are criticality 1R/2

PREVIOUS SPACE SHUTTLE MISSION OV-103 STS-96 IN-FLIGHT ANOMALIES	Presenter:
	Organization/Date: Orbiter/11-19-99

5 Problems Have Been Identified As In-Flight Anomalies: (Cont)

- STS-96-V-03: Vestibule pressure loss during EVA
  - During external airlock depressurization for EVA, an indication of leakage from the vestibule to the airlock was noted
    - Airlock/vestibule delta pressure data indicated the transfer of gas across the hatch, relieving the delta pressure load
  - Post-flight troubleshooting isolated cause of leak path through hatch/collar seal due to high negative delta pressure
    - Cause attributed to hatch seal not to drawing dimension in combination with large collar gap
  - No further troubleshooting/re-rigging planned for this flow
    - D hatch seal (during STS-103) is not exposed to any negative delta pressures
  - PRT has follow on action to evaluate rigging specification to ensure future negative D hatch seal capability

PREVIOUS SPACE SHUTTLE MISSION OV-103 STS-96 IN-FLIGHT ANOMALIES	Presenter:
	Organization/Date: Orbiter/11-19-99

5 Problems Have Been Identified As In-Flight Anomalies: (Cont)

- STS-96-V-04: Humidity separator B water carryover
  - At approximately 001:01:30 MET, during a planned crew inspection, water was detected in the ECLSS bay area near the humidity separator
  - Humidity separator B was running during that time
    - Crew observed water exiting the humidity separator air outlet port
  - Crew removed the water and switched from humidity separator B to A
  - Data review indicated no leakage in any water-related systems (water coolant loop, supply and waste water tanks)
  - Cause of problem has been verified to be clogging of the humidity separator's water flow path by small amount of debris and HX hydrophilic coating material

PREVIOUS SPACE SHUTTLE MISSION OV-103 STS-96 IN-FLIGHT ANOMALIES	Presenter:
	Organization/Date: Orbiter/11-19-99

5 Problems Have Been Identified As In-Flight Anomalies: (Cont)

- STS-96-V-04: Humidity separator B water carryover (cont)
  - Clogging of separator is a function of time
    - Not an immediate effect but debris builds over several missions
  - Redundant separator available
  - Contingency procedure to effect minimum duration mission in the event of complete loss of humidity separators
  - The humidity separator has been removed and replaced

PREVIOUS SPACE SHUTTLE MISSION OV-103 STS-96 IN-FLIGHT ANOMALIES	Presenter:
	Organization/Date: Orbiter/11-19-99

5 Problems Have Been Identified As In-Flight Anomalies: (Cont)

- STS-96-V-05: Space to space communication system (SSCS) EVA communication problems (GFE)

	Presenter:
	Organization/Date: Orbiter/11-19-99

ENGINEERING REQUIREMENTS BACKUP

STS-103 OVEI & OMRSD EXCEPTIONS & WAIVERS

Presenter:

Organization/Date: Orbiter/11-19-99

Exception / Waiver	STS	TITLE	APPROVAL DATE
OMRS EK03878	103	(S00) SCAN RETEST OF RADIATOR DEPLOY TALK	10/22/99
OMRS WK03875R2	103	(V05) UNPLANNED PURGE OUTAGE	10/25/99
OMRS WK03874R1	103	(V30) PLBD MOISTURE CONDITIONING OUTAGE	10/25/99
OMRS WK03873R1	103	(V74) UHF AIRLOCK ANTENNA RETURN LOSS	11/1/99
OMRS EK03877	103	(V42) LV358 R&R RETEST REQUIREMENT	10/14/99
OMRS WK03868R1	103	(V41) SSME HOT GAS SYSTEM PRESSURIZATION	09/17/99
OMRS WK03883	103	(V58) HYDRAULIC CIRC PUMP PRESTART CRITERIA	11/01/99
OVEI Waiver	103	Standard Weight Locker Sleeve Bolt Understrength for Crash Loads	10/29/99
OVEI Waiver	103	Light Weight Locker Sleeve Bolt Understrength for Crash Loads	10/29/99
OVEI Waiver	103	Emergency Egress Slide System deceleration strip Coefficient of Friction is too High	10/29/99

	Presenter:
	Organization/Date: Orbiter/11-19-99

MISSION KITS

STS-103 MISSION KIT CONFIGURATIONS

Presenter:

Organization/Date: Orbiter/11-19-99

84 Mission Kits Are Manifested (MECSLSI & CCCD) For STS-103:

- Six are flying for the first time
  - MV0529A Rendezvous and docking floodlights
  - MV0548A Bulkhead CCTV illuminators
  - MV0549A PLB floodlights
  - MV0617A EVA slidewire
  - MV0849A Tool stowage assembly
  - MV0602A Lightweight stowage lockers

STS-103
MISSION KIT CONFIGURATIONS

Presenter:

Organization/Date:
Orbiter/11-19-99

	MISSION KIT	TITLE	COMMENTS
	MV0072P	PAYLOAD GFE	PAYLOAD KIT
	MV0073A	PAYLOAD SUPPORT EQUIPMENT	
	MV0076A	ORBITER DOCKING SYSTEM MECHANISM	
	MV0082A	REMOTE MANIPULATOR SYSTEM (SRMS)	
	MV0412A	S-BAND FM SYSTEM	
	MV0413A	CENTAUR STRUCTURE	
	MV0426A	MADS III	
	MV0465A	GN2 SUPPLY	
	MV0485A	TACAN COOLING PROVISIONS	
	MV0494A	GPS/INS DTO	
	MV0520A	PAYLOAD HEAT REJECTION (RAD PANELS)	
	MV0525A	PRSD SYSTEM TANK SET 4	
*	MV0529A	RENDEZVOUS AND DOCKING FLOODLIGHT	NEW SEAL DESIGN
	MV0532A	PAYLOAD BAY LINER	
	MV0539A	RTG COOLING AND GN2 PURGE	
	MV0544A	PRSD TANK SET 4	
	MV0545A	COMSEC EQUIPMENT	
	MV0546A	THERMAL CONTROL ACCOMMODATION KIT	

*** FIRST FLIGHT**

STS-103
MISSION KIT CONFIGURATIONS

Presenter:

Organization/Date:
Orbiter/11-19-99

	MISSION KIT	TITLE	COMMENTS
*	MV0548A CONFIGS. (GFE)	BULKHEAD CLOSED CIRCUIT TV	NEW ILLUMINATOR
*	MV0549A	PAYLOAD BAY FLOODLIGHTS	NEW SEAL DESIGN
	MV0557A	KEEL CAMERA ASSY	
	MV0566A	PRSD TANK SET 5	
	MV0568A	PROVISIONS STOWAGE ASSY (PSA)	
	MV0573A	AFT FUSELAGE BALLAST ASSY	525 LBS.
*	MV0617A (GFE)	EVA SLIDEWIRE	NEW TETHER HOOK LOCKS
	MV0622A	PAYLOAD BAY FLAG	
	MV0643A	MMU ORBITER PROVISIONS KIT	
	MV0702A	PAYLOAD TIMING BUFFER	
	MV0711A	HARNESS INSTL, 576/603 INTFCE	
	MV0712A	STD MIXED CARGO HARNESS INSTL (SMCH)	PAYLOAD KIT
	MV0713A	HARNESS INSTL, 1203/1307 INTFCE	
	MV0719A	AFT FLIGHT DECK SMCH	PAYLOAD KIT
	MV0724A	GETAWAY SPECIAL (GAS) INTEG HDWE	
	MV0725A	STD I/F PANEL (SIP) KIT	PAYLOAD KIT
	MV0726A	PAYLOAD ACTIVE COOLING KIT (PACK)	PAYLOAD KIT

*** FIRST FLIGHT**

STS-103
MISSION KIT CONFIGURATIONS

Presenter:

Organization/Date:
Orbiter/11-19-99

MISSION KIT	TITLE	COMMENTS
MV0727A	SPACELAB PAYLOAD BAY FLUID KIT	
MV0725A	INCR CAP. ADAPTIVE P/L CARRIER (ICAPC)	
MV0766A	PLB CABLE & FLUID LINE LONGERON	
MV0787A	KEEL CAMERA INST HDWE	PAYLOAD KIT
MV0828A	EXTERNAL AIRLOCK	ODS VENT T-MOD, AIRLOCK CANOPY SCAR
MV0842A	INTEGRATION HARDWARE KIT	
MV0845A	ISS INTEGRATION HARDWARE	UNIQUE LINER CUTOUTS FOR APCU WIRING
* MV0849A	TOOL STOWAGE ASSY	NEW TOOL STOWAGE CUSHIONS
MV0846A	FIBER OPTICS INTEG HARDWARE	FIBER OPTIC CONNECTOR ON 576 BULKHEAD
MV0866A	IVHM	REMOVAL OF INSTALLATIONS
MV0645A	LW MAR CLOSEOUT/VELCRO	
* MV0602A	LW STOWAGE LOCKERS	FIRST FLIGHT - 20 OF 44
MV0859A	FITTINGS - HVY P/L, GALLEY, LW MAR	
MV0653A	SORG	
MV0627A	LIOH CONTAINER	
MV0669A	SLEEPING BAGS	

*** FIRST FLIGHT**

STS-103
MISSION KIT CONFIGURATIONS

Presenter:

Organization/Date:
Orbiter/11-19-99

MISSION KIT	TITLE	COMMENTS
MV0828A	EXT AIRLOCK	
	ON ORBIT RETENTION STRAPS	
	CLOSEOUT NETTING	
	EMERG. EGRESS NETTING	
	MIDDECK FLOOR PANEL	
	MFG ACCESS PANEL	
	576 HATCH STRAP	
	ON ORBIT BUNGEE	
	STBD FLOOR STOWAGE BAG	
	PORT FLOOR STOWAGE BAG	
	EMU ADAPTER PALLET	
	20G EMU COVER	
MV0606A	AIRLOCK STOWAGE KIT SERVICING & COOLING UMBILICAL	
MV0627A	MULT. HEADSET ADAPTER PLATE ASSY	
MV0669A	CUE CARD SUPPORT	
MV0610A	HAND CONTROLLER INSTLN	
MV0226A	M/S LW SEATS	

*** FIRST FLIGHT**

STS-103
MISSION KIT CONFIGURATIONS

Presenter:

Organization/Date:
Orbiter/11-19-99

MISSION KIT	TITLE	COMMENTS
MV0225A	CDR/PLT LW SEATS COOLING UNIT MOUNTING BKTS (AFT/STBD) FLT DATA FILE EGRESS HANDHOLD	
MV0612A	MIDDECK STRUCTURAL CLOSEOUT KIT	
MV0669A	WMC & HARDWARE REQUIRED	
MV0627A	CPU ORIFICE SCREEN	
MV0669A	VOLUME 3B STOWAGE	
MV0424A	CIRCUIT BREAKER COLOR CODE KIT	
MV0669A	INTERDECK LIGHT SHIELDS	
MV0611A	WINDOW SHADES	
MV0603A	VOLUME B	
MV0603A	VOLUME A	
MV0082A	RMS CONTROLLERS/PANELS	
MV0426A	A6/A2 D&C PANELS	
MV0418A	MCDS	
MV0712A	CIP/OPP/OSVU	
MV0719A	TVIP/SSP3 - AFT STOWAGE	
MV0734A	LI5 ACCESS PANEL	
MV0657A	CABLE TRAY	

*** FIRST FLIGHT**

STS-103
MISSION KIT CONFIGURATIONS

Presenter:

Organization/Date:
Orbiter/11-19-99

MISSION KIT	TITLE	COMMENTS
MV0607A	SKY GENIE	
MV0651A	EMERGENCY EGRESS SLIDE	
MV0669A	EGRESS PLATFORM	
MV0669A	LADDER	
MV0828A	FIRE EXTINGUISHER	
MV0610A	SPHERICAL STUDS	
MV0074A	AV BAY SEC PNL	
MV0870A	TEPC PANEL	
MV0655A	AV BAY WIRE TRAY - SCAMP	
MV0827A	CPU/CABLE/SPARE PDI/SPARE MCIU	

* FIRST FLIGHT

	Presenter:
	Organization/Date: Orbiter/11-19-99

CONFIGURATION CHANGES BACKUP

CONFIGURATION CHANGES AND CERTIFICATION STATUS

Presenter:

Organization/Date:
Orbiter/11-19-99

OV-103 STS-103 Modification Certification

MCR/Modification	Certification Method			Certification Approval Request No.	Approval Date	Remarks
	Test	Analysis	Similarity			
Current Mission Requirements						
19030 Airlock Venting Mod FIRST FLIGHT			X	04-35-643051-001C Submitted 8/3/99	9-30-99A	• Removed external airlock depress valve "tee" and modified depress valve cap to preclude potential HST solar panel damage during servicing EVA's
19331 Tunnel Adapter Lighting Wiring (Backout) FIRST FLIGHT			X	N/A		• Removed aft TAA orbiter lighting wiring - aft TAA not manifested this flight
19046 IVHM SCAR Removal - Mid- Above Liner - Aft- Wiring/Sensors			X	N/A		• Removed IVHM wiring/hardware/sensors from midbody and aft
11621 AC Bus Wire Harness Separation FIRST FLIGHT				N/A		• Separates both AC wire harnesses

CONFIGURATION CHANGES AND CERTIFICATION STATUS

Presenter:

Organization/Date:
Orbiter/11-19-99

OV-103 STS-103 Modification Certification

MCR/Modification	Certification Method			Certification Approval Request No.	Approval Date	Remarks
	Test	Analysis	Similarity			
Current Mission Requirements (Cont.)						
19398 Space-To-Space Orbiter Radio (SSOR) Backout FIRST FLIGHT				N/A (Certification not affected - uses previously certified materials)		• Removal of the Space-to-Space Orbiter Radio (SSOR) and the re-activation of the Air Traffic Control (ATC) UHF
19362 Drag Chute Mortar Box Upgrade FIRST FLIGHT		X	X	139-06-200002-002G Submitted 8/3/99	10/14/99A	• Stronger hi-locks in place of rivets
		X		139A-06-200002-002G Submitted 9/27/99	10/14/99A	• Additional info for original analysis submitted
	X	X		02-44-621-0076I Errata to QSA Submitted 9/03/99	10/28/99A 11/10/99A	• Drag Chute system less mortar strap bolt upgrade • Submitted Erratta 11-19-99 to permit usage during aborts
19392 Base Heat Shield and Body Flap Acoustic Cap Modification FIRST FLIGHT				N/A		• Previously certified materials • Same as drag chute mod stinger microphone
11621 TSA Fitting Fix and Blanket Modification FIRST FLIGHT				40-09-362000-001BE Submitted 10/20/99	11/16/99A	• Facilitates TSA installation and rigging on airlock truss

CONFIGURATION CHANGES AND CERTIFICATION STATUS

Presenter:

Organization/Date:
Orbiter/11-19-99

OV-103 STS-103 Modification Certification

MCR/Modification	Certification Method			Certification Approval Request No.	Approval Date	Remarks
	Test	Analysis	Similarity			
Future Mission Requirements						
19045 Completion of WLE RCC Insulator Mod	X	X		35-08-199200-003R	2/25/99A	• Partial deferral from flight 26
19268 External Airlock Canopy Mod			X	114-04-341002D Submitted 9/10/99	10/28/99A	• Partial installation - SCAR 44 canopy brackets installed
			X	39-09-362000-001BD Submitted 9/08/99	10/14/99A	• TCS blankets modified to accommodate installed brackets
17177 A7 Switch Panel Decal Mod				N/A		• Removed "Payload/VTR Record" decal from A7 panel switch 26 to expose underlying "PAYLOAD" decal

CONFIGURATION CHANGES AND CERTIFICATION STATUS

Presenter:

Organization/Date:
Orbiter/11-19-99

OV-103 STS-103 Modification Certification

MCR/Modification	Certification Method			Certification Approval Request No.	Approval Date	Remarks
	Test	Analysis	Similarity			
Process Improvement 18883 Advanced Air Data Transducer (AADT) FIRST FLIGHT	X			01-17-409-0224-0002A [avionics] Addendum submitted by CAR 01C on 8/4/99	9/03/99A	• Installed one new AADT to replace the existing ADTA in avionics bay 1 (slot 1) • Single string development/ confidence flight prior to full implementation • CAR 010 submitted 9-01-99
		X	X	08-22-613400-001H [Ducting]	10/13/98A	• Blanking plate installed in the crew compartment avionics bay ECLSS cooling air supply ducting
17177 Waste Water QD / Urine Filter Assy Dwg Change				03-23-286-0075-0001E	9/30/99A	• Allows for assembly to take place at KSC
19288 Completion Of DMHS Nut-plate Mod		X		154-03-350013-001K	3/19/99A	• Corrects damaged holes and prevents future damage to the DMHS heat shield and mounting structure holes by installing stainless steel bushings with laminated shims

CONFIGURATION CHANGES AND CERTIFICATION STATUS

Presenter:

Organization/Date:
Orbiter/11-19-99

OV-103 STS-103 Modification Certification

MCR/Modification	Certification Method			Certification Approval Request No.	Approval Date	Remarks
	Test	Analysis	Similarity			
Corrective Action						
19309 Replacement of OMS Pod Y-web Door AFRSI Carrier Panels With FRSI			X	19-07-396001-002P	7/12/99A	• Replaced Y-web door AFRSI carrier panels with FRSI bonded directly to the structure Partial - Left OMS only
17177 PLB Floodlight Modification			X	02-19-704032-001D	8/6/99A	• Partial - 4 of 7 PLB floodlights changed out

CONFIGURATION CHANGES AND CERTIFICATION STATUS

Presenter:

Organization/Date:
Orbiter/11-19-99

OV-103 STS-103 Modification Certification

MCR/Modification	Certification Method			Certification Approval Request No.	Approval Date	Remarks
	Test	Analysis	Similarity			
Corrective Action						
19381 Lightweight Seat Back Mod	X		X	01-25-39129185-301D [pilot & commander seats]	7/28/99A	• Re- identification deferred from last flow (Flt. 26)
	X		X	01-25-39126815-301B [mission specialist seats]	7/28/99A	• Partial - Re ID only deferred from last flight

CONFIGURATION CHANGES AND CERTIFICATION STATUS

Presenter:

Organization/Date:
Orbiter/11-19-99

OV-103 STS-103 Modification Certification

MCR/Modification	Certification Method			Certification Approval Request No.	Approval Date	Remarks
	Test	Analysis	Similarity			
Certification Extensions						
17276 17-Inch Disconnect	X			01-10-284-0389-1701B CAR 01A submitted 7/26/99 to update the Parker stress analysis to Rev. B	11125/99A	• Extends from 27 flights to 100 flights
19196 Fuel Cell Performance Monitoring Delta Certification	X			03-20-800-165-501B Submitted 8/3/99	8/18/99A	• Delta qualification vibration test to extend certification to 100 flights
Cryo Filter Operational Life Extension	X	X		02-15-286-0054-0001B Submitted 7/15/99	8/31/99A	• Delta qualification to extend filter life from 25 to 65 flights
18863 MMU Tape Replacement	X	X	X	04-39-615-0005-0102H Submitted 8/26/99	10/13/99A	• Extension from 1 flight to 100 flights
19137 APU Fuel Pump Redesign - Partial	X	X	X	16-16-201-0001-0400AA Submitted 10/09/99	11/09/99A	• Fuel pump polysulfide sealant only
Hydraulic Pump Certification Deviation		X		4A-30-281-0029-0002F Submit 11-05-99	11/17/99A	• Pump configuration issue during certification/ATP
IMU Muffler Acoustic Foam		X		03-22-613526-001B Submit 11-05-99	11/17/99A	• Aerofonic foam replaces Scottfelt foam certification good from flight 27 to flight 100

	Presenter:
	Organization/Date: Orbiter/11-19-99

SPECIAL TOPICS BACKUP

	Presenter:
	Organization/Date: Orbiter/11-19-99

D&C PANEL C3 MAIN ENGINE SHUTDOWN SWITCH MARKING ERROR

BACKUP

D&C PANEL C3 MAIN ENGINE SHUTDOWN SWITCH MARKING ERROR	Presenter:
	Organization/Date: Orbiter/11-19-99

Main Engine Shutdown Switches (Panel C3)

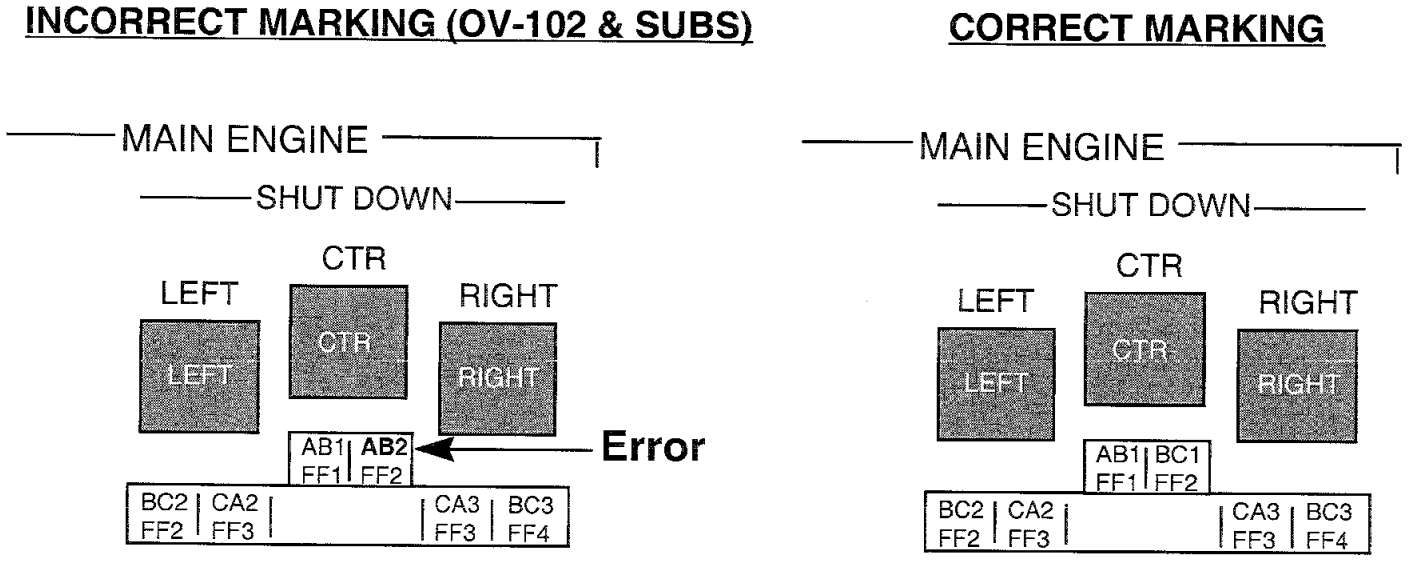

Figure 1

Note: Drawing for illustration purposes only

D&C PANEL C3 MAIN ENGINE SHUTDOWN SWITCH MARKING ERROR	Presenter:
	Organization/Date: Orbiter/11-19-99

Discussion: (Cont)

- Orbiter wiring drawings are controlled at different levels
  - The Automated Wire List (AWL) is a formally released, Configuration Management controlled, Engineering Product
  - Identifies all Orbiter wire, harnesses, cables, connectors, pins, etc.
    - Parts traceability requirements are imposed
  - Identifies end-to-end terminations, routing and wire lengths of Orbiter wiring
  - Engineering requirements for Manufacturing, Test and Installation of Orbiter wiring
  - Changed only with Program direction

D&C PANEL C3 MAIN ENGINE SHUTDOWN SWITCH MARKING ERROR	Presenter:
	Organization/Date: Orbiter/11-19-99

Discussion: (Cont)

- Orbiter wiring drawings are controlled at different levels
  - The Orbiter Subsystem Schematics are released for "Reference Only"
    - "Reference Only" means "Cannot be used to manufacture hardware"
      - No parts traceability requirements imposed
  - Subsystem Schematics are an end-to-end mapping of Orbiter electrical wiring/system functionality
    - Tool used in Orbiter Design/Development to coordinate system options, resolve conflicts among systems prior to release to Manufacturing by the AWL
    - Subsystem Schematics control is maintained within RSS Avionics Design Engineering
    - Program CM requirements not imposed
    - Design changes accumulated and incorporated at periodic intervals

D&C PANEL C3 MAIN ENGINE SHUTDOWN SWITCH MARKING ERROR	Presenter:
	Organization/Date: Orbiter/11-19-99

Actions Taken: (Cont)

- Evaluation Determined That ECN Driven Change Incorporation Into Orbiter Schematics is Performed in a Timely Fashion
  - Surveyed change traffic associated with all 520 Orbiter Schematics
  - 97 ECNs processed during last 5 years to incorporate MCR-driven changes
    - 82 ECNs have been incorporated
    - 3 ECNs are awaiting incorporation
    - 12 ECNs are in-work for modifications not yet implemented

D&C PANEL C3 MAIN ENGINE SHUTDOWN SWITCH MARKING ERROR

Presenter:

Organization/Date:
Orbiter/11-19-99

NOMENCLATURE ERRORS FOR SUPPLEMENTAL DECALS

THESE DECALS HAVE BEEN CORRECTED ON THE VEHICLE (11/17/99)

	VS70-XXXXXX		V070-XXXXXX		ACTUAL VEHICLE CONFIGURATION			
SWITCH	SUBSYSTEM SCHEMATIC	AWL	DECAL DWG	DECAL INSTL DWG	OV-103	OV-104	OV-105	OV-102
PANEL O7, RIGHT RCS XFEED 3/4/5	AC1	AC1	AC2	AC2	AC1	AC1	AC1	AC1
PANEL C3, CNTR MAIN ENGINE SHUTDOWN	AB1/FF1	AB1/FF1	AB1/FF1	AB1/FF1	AB1/FF1	AB1/FF1	AB1/FF1	AB1/FF1
	AB2/FF2	BC1/FF2	AB2/FF2	AB2/FF2	AB2/FF2	AB2/FF2	AB2/FF2	AB2/FF2
PANEL C3, RIGHT MAIN ENGINE SHUTDOWN	CA3/FF3	CA3/FF3	CA3/FF3	CA3/FF3	CA3/FF3	CA3/FF3	CA3/FF3	CA3/FF3
	BC3/FF4	BC3/FF4	BC2/FF4	BC3/FF4	BC3/FF4	?	?	BC3/FF4
PANEL L1, LOOP1 RAD BYPASS VLV MODE	MNB/BC1	MNC/BC1	MNB/BC1	MNB/BC1	MNB/BC1	MNC/BC1	MNB/BC1	MNB/BC1
	MNA/AB1	MNA/AB1	MNA/AB1	MNA/AB1	MNA/AB1	MNA/AB1	MNA/AB1	MNA/AB1
PANEL L1, LOOP2 RAD BYPASS VLV MODE	MNC/CA1	MNB/CA1	MNC/CA1	MNC/CA1	MNC/CA1	MNB/CA1	MNC/CA1	MNC/CA1
	MNA/AB1	MNA/AB1	MNA/AB1	MNA/AB1	MNA/AB1	MNA/AB1	MNA/AB1	MNA/AB1

KEY:
NOMENCLATURE ERRORS

D&C PANEL C3 MAIN ENGINE SHUTDOWN SWITCH MARKING ERROR

Presenter:

Organization/Date:
Orbiter/11-19-99

NOMENCLATURE STATUS FOR CREW PREFERENCE SUPPLEMENTAL DECALS (1 OF 2)

						VS70-XXXXXX	V070-XXXXXX			ACTUAL VEHICLE CONFIGURATION			
PANEL	SYSTEM				SWITCH	SUBSYSTEM SCHEMATIC	AWL	DECAL DWG	DECAL INSTL DWG	OV-103	OV-104	OV-105	OV-102
O5													
	OMS												
		LEFT	ISO	A	S19	AC1	AC1	AC1	AC1				
				B	S20	AC3	AC3	AC3	AC3				
			XFEED	A	S26	AC1	AC1	AC1	AC1				
				B	S27	AC2	AC2	AC2	AC2				
		RIGHT	ISO	A	S21	AC1	AC1	AC1	AC1				
				B	S22	AC3	AC3	AC3	AC3				
			XFEED	A	S28	AC3	AC3	AC3	AC3				
				B	S29	AC2	AC2	AC2	AC2				
		FWD	TNK ISO	1/2	S23	AC3	AC3	AC3	AC3				
				3/4/5	S24	AC1	AC1	AC1	AC1				
			MNF ISO	1	S30	AC1	AC1	AC1	AC1				
				2	S31	AC2	AC2	AC2	AC2				
				3	S32	AC3	AC3	AC3	AC3				
				4	S33	AC3	AC3	AC3	AC3				
O7													
	RCS												
		LEFT	TNK ISO	1/2	S16	AC3	AC3	AC3	AC3				
				3/4/5A	S17	AC1	AC1	AC1	AC1				
				3/4/5B	S18	AC2	AC2	AC2	AC2				
			MNF ISO	1	S22	AC2/FA1	AC2/FA1	AC2/FA1	AC2/FA1				
				2	S23	AC1/FA3	AC1/FA3	AC1/FA3	AC1/FA3				
				3	S24	AC3/FA2	AC3/FA2	AC3/FA2	AC3/FA2				
				4	S25	AC3/FA4	AC3/FA4	AC3/FA4	AC3/FA4				
				5	S26	FA1	FA1	FA1	FA1				
			XFEED	1/2	S32	AC3	AC3	AC3	AC3				
				3/4/5	S33	AC1	AC1	AC2	AC2	AC1	AC1	AC1	AC1
		RIGHT	TNK ISO	1/2	S19	AC3	AC3	AC3	AC3				
				3/4/5A	S20	AC1	AC1	AC1	AC1				
				3/4/5B	S21	AC2	AC2	AC2	AC2				
			MNF ISO	1	S27	AC2/FA1	AC2/FA1	AC2/FA1	AC2/FA1				
				2	S28	AC1/FA3	AC1/FA3	AC1/FA3	AC1/FA3				
				3	S29	AC3/FA2	AC3/FA2	AC3/FA2	AC3/FA2				
				4	S30	AC3/FA4	AC3/FA4	AC3/FA4	AC3/FA4				
				5	S31	FA2	FA2	FA2	FA2				
			XFEED	1/2	S34	AC3	AC3	AC3	AC3				
				3/4/5	S35	AC1	AC1	AC1	AC1				
F7													
	DPS		CRT	1		MNA-AB1	MNA-AB1	MNA-AB1	MNA-AB1				
				2		MNB-BC2	MNB-BC2	MNB-BC2	MNB-BC2				
				3		MNC-CA1	MNC-CA1	MNC-CA1	MNC-CA1				
C3													
	MPS	MAIN ENG	SHUT DW	LFT	S12	BC2/FF2	BC2/FF2	BC2/FF2	BC2/FF2				
						CA2/FF3	CA2/FF3	CA2/FF3	CA2/FF3				
				CTR	S13	AB1/FF1	AB1/FF1	AB1/FF1	AB1/FF1	AB1/FF1	AB1/FF1	AB1/FF1	AB1/FF1
						AB2/FF2	BC1/FF2	AB2/FF2	AB2/FF2	AB2/FF2	AB2/FF2	AB2/FF2	AB2/FF2
				RT	S14	CA3/FF3	CA3/FF3	CA3/FF3	CA3/FF3	CA3/FF3	CA3/FF3	CA3/FF3	CA3/FF3
						BC3/FF4	BC3/FF4	BC3/FF4	BC3/FF4	BC3/FF4	?	?	BC3/FF4
L2													
	FLASH EVAP		SUPPLY A	1	S23	MNA/AB2	MNA/AB2	MNA/AB2	MNA/AB2				
				2		MNB/BC2	MNB/BC2	MNB/BC2	MNB/BC2				
			SUPPLY B	1	S24	MNC/AB1	MNC/AB1	MNC/AB1	MNC/AB1				
				2		MNA/CA1	MNA/CA1	MNA/CA1	MNA/CA1				

D&C PANEL C3 MAIN ENGINE SHUTDOWN SWITCH MARKING ERROR

Presenter:

Organization/Date:
Orbiter/11-19-99

NOMENCLATURE STATUS FOR CREW PREFERENCE SUPPLEMENTAL DECALS (2 OF 2)

PANEL	SYSTEM				SWITCH	V070-XXXXXX SUBSYSTEM SCHEMATIC	AWL	V070-XXXXXX DECAL DWG	DECAL INSTL DWG	ACTUAL VEHICLE CONFIGURATION OV-103	OV-104	OV-105	OV-102
L1													
	CABIN FAN			A	S17	AC3	AC3	AC3	AC3				
				B	S18	AC2	AC2	AC2	AC2				
		TEMP CNTR		1	S11	AC2	AC2	AC2	AC2				
				2		AC1	AC1	AC1	AC1				
		HUMD SEP		A	S1	AC1	AC1	AC1	AC1				
				B	S2	AC2	AC2	AC2	AC2				
	IMU FAN			A	S12	AC1	AC1	AC1	AC1				
				B	S13	AC2	AC2	AC2	AC2				
				C	S14	AC3	AC3	AC3	AC3				
	AV BAY 1 FAN			A	S9	AC1	AC1	AC1	AC1				
				B	S10	AC2	AC2	AC2	AC2				
	AV BAY 2 FAN			A	S15	AC2	AC2	AC2	AC2				
				B	S16	AC3	AC3	AC3	AC3				
	AV BAY 3 FAN			A	S19	AC3	AC3	AC3	AC3				
				B	S20	AC1	AC1	AC1	AC1				
	H20 LOOP	1		A	S44	AC1	AC1	AC1	AC1				
				B		AC2	AC2	AC2	AC2				
		2		GPC	S6	AC1	AC1	AC1	AC1				
				ON		AC3	AC3	AC3	AC3				
		LOOP 1 BYPASS			S4	AC3	AC3	AC3	AC3				
					S5	AC3	AC3	AC3	AC3				
		LOOP 2 BYPASS			S7	AC1	AC1	AC1	AC1				
					S8	AC1	AC1	AC1	AC1				
	ECLSS												
		F/L HX	LOOP1		S21	AC2	AC2	AC2	AC2				
			LOOP2		S22	AC3	AC3	AC3	AC3				
		FLASH EVPR	IA	GPC	S31	MNC/CA1	MNC/CA1	MNC/CA1	MNC/CA1				
				ON		CA2	CA2	CA2	CA2				
			PRIB	GPC	S32	MNA/AB1	MNA/AB1	MNA/AB1	MNA/AB1				
				ON		AB2	AB2	AB2	AB2				
			SEC	GPC	S33	MNB/BC2	MNB/BC2	MNB/BC2	MNB/BC2				
				ON		BC3	BC3	BC3	BC3				
		EVAP HTR	L NOZZLE	A	S37	MNA/BC1	MNA/BC1	MNA/BC1	MNA/BC1				
				B		MNB/AB2	MNB/AB2	MNB/AB2	MNB/AB2				
			R NOZZLE	A	S38	MNB/BC3	MNB/BC3	MNB/BC3	MNB/BC3				
				B		MNC/CA1	MNC/CA1	MNC/CA1	MNC/CA1				
		NH3 CNTR	TNK A	GPC	S42	MNA/BC3	MNA/BC3	MNA/BC3	MNA/BC3				
				ON		MNC/AB1-CA2	MNC/AB1-CA2	MNC/AB1-CA2	MNC/AB1-CA2				
			TNK B	GPC	S43	MNC/BC2	MNC/BC2	MNC/BC2	MNC/BC2				
				ON		MNB/AB2-CA1	MNB/AB2-CA1	MNB/AB2-CA1	MNB/AB2-CA1				
		FREON PI	LOOP 1	A	S23	AC1	AC1	AC1	AC1				
				B		AC2	AC2	AC2	AC2				
			LOOP 2	A	S24	AC3	AC3	AC3	AC3				
				B		AC1	AC1	AC1	AC1				
		RAD CNTR	LOOP 1	A	S26	AC2	AC2	AC2	AC2				
				B		AC1	AC1	AC1	AC1				
			LOOP2	A	S27	AC3	AC3	AC3	AC3				
				B		AC1	AC1	AC1	AC1				
		BYPASS VALVE											
		MAN SEL	LOOP 1	FLOW	S29	AC2/AC1	AC2/AC1	AC2/AC1	AC2/AC1				
			LOOP 2	FLOW	S30	AC3/AC1	AC3/AC1	AC3/AC1	AC3/AC1				
		MODE	LOOP 1	MAN	S35	MNB/BC1	MNC/BC1	MNB/BC1	MNB/BC1	MNB/BC1	MNC/BC1	MNB/BC1	MNB/BC1
						MNA/AB1	MNA/AB1	MNA/AB1	MNA/AB1	MNA/AB1	MNA/AB1	MNA/AB1	MNA/AB1
			LOOP 2	MAN	S36	MNC/CA1	MNB/CA1	MNC/CA1	MNC/CA1	MNC/CA1	MNB/CA1	MNC/CA1	MNC/CA1
						MNA/AB1	MNA/AB1	MNA/AB1	MNA/AB1	MNA/AB1	MNA/AB1	MNA/AB1	MNA/AB1

D&C PANEL C3 MAIN ENGINE SHUTDOWN SWITCH MARKING ERROR

Presenter:

Organization/Date:
Orbiter/11-19-99

Results of Subsystem Schematic vs. AWL Verification for Crit. 1/1 FMEA/CIL Items

	CRIT 1/1 FUNCTIONS	SCHEMATICS	MISSING INFORMATION	INCORRECT INFORMATION	FUNCTIONAL ERRORS (ERRORS AFFECTING ORBITER OPERATION)
1	HELIUM BLOW DOWN VALVES	VS70-410139	0	0	0
2	LH2 HELIUM MANIFOLD REPRESS VALVES	VS70-410139	1	0	0
3	RCS OXID/FUEL TANK ISOLATION VALVES	VS70-420203	4	2	0
		VS70-420303	0	0	0
4	LH2 RECIRCULATION DISCONNECT VALVE	VS70-410129	0	0	0
5	LO2 POGO RECIRCULATION VALVES	VS70-410119	0	0	0
6	LEFT & RIGHT OMS ENGINE PRESS ISO VALVES	VS70-430209	0	0	0
		VS70-430309	1	1	0
7	LEFT & RIGHT OMS ENGINE PURGE VALVES	VS70-430209	4	1	0
		VS70-430309	0	0	0
8	GH2 FLOW CONTROL VALVES	VS70-410169	3	0	0
9	APU GGVM SHUTOFF VALVE CONTROL	VS70-460109	1	0	0
10	RMS POWER	VS70-540109	0	0	0
11	RMS CONNECTORS	VS70-540109	6	6	0
12	APU FUEL LINE HEATERS	VS70-460109	24	3	0
13	LANDING GEAR DOWN CONTROL	VS70-510109	3	6	0
		TOTAL:	*47*	*19*	*0*

MISSING INFORMATION:
- *CABLE HARNESS REFERENCE DESIGNATOR (16)*
- *LRU REFERENCE DESIGNATOR (1)*
- *CONNECTOR REFERENCE DESIGNATOR (2)*
- *PIN OR SPLICE IDENTIFICATION (21)*
- *COMPONENT (7)*

INCORRECT INFORMATION:
- *CABLE HARNESS REFERENCE DESIGNATOR (6)*
- *CONNECTOR REFERENCE DESIGNATOR (1)*
- *PIN OR SPLICE IDENTIFICATION (8)*
- *WIRE ROUTING (4)*

Table 1

D&C PANEL C3 MAIN ENGINE SHUTDOWN SWITCH MARKING ERROR

Presenter:

Organization/Date:
Orbiter/11-19-99

	MPS Subsystem Drawing Review	SCHEMATICS	MISSING INFORMATION	INCORRECT INFORMATION	FUNCTIONAL ERRORS (ERRORS AFFECTING ORBITER OPERATION)
1	MPS Feed, Recirculation & POGO	VS70-410119	4	2	0
2	SSME Interface	VS70-410149	16	16	0
3	MPS Liquid level and pressurization and control	VS70-410169	14	3	0
			0	0	0
		TOTAL:	34	*21*	*0*

MISSING INFORMATION:
- *CABLE HARNESS REFERENCE DESIGNATOR*
- *LRU REFERENCE DESIGNATOR*
- *CONNECTOR REFERENCE DESIGNATOR*
- *PIN OR SPLICE IDENTIFICATION*
- *COMPONENT*

INCORRECT INFORMATION:
- *CABLE HARNESS REFERENCE DESIGNATOR*
- *CONNECTOR REFERENCE DESIGNATOR*
- *PIN OR SPLICE IDENTIFICATION*
- *WIRE ROUTING*

Table 2

D&C PANEL C3 MAIN ENGINE SHUTDOWN SWITCH MARKING ERROR

Presenter:

Organization/Date:
Orbiter/11-19-99

MCR	REF	ECN	TITLE	ECN DATES	STATUS (Schematic Incor
8613		104-25020	MIR 2/ODS Interface Def	Jan-95	COMPLETED
8644		104-25021	Payload Pwr Sw Unit Update	Jan-95	COMPLETED
10496		105-0073	Impl SSME B-II Controller	9/91,5/94	COMPLETED
11719		103-25013	APU Wtr Valve Redesign	5/93,1/94	COMPLETED
12154		105-25005	ET Door/Uplock Latch Actuators	5/93,10/94(both WD)	COMPLETED
12999		105-25010	OV105 Land'g Gear Deploy Rewire	Jan-96	COMPLETED
13257	16928/1813	105-0025	PRSD 5th Tank OV 105	88,89,92,94	COMPLETED
16785		103-20003	Orb/ET Con WH Redesign	8/91 WD 3-2-94	COMPLETED
17004		103-09003	Reloc Bay 2 BN2 Tank-Bay 10	4/91 WD 3-2-94	COMPLETED
17177		102-25028	Removal EDO Cmd Decoder	Apr-98	COMPLETED
17177		103-25050	MDM Rech Hydraulic Supt	Feb-99	COMPLETED
17222	PCIN R6491	102-25030	Harness Mods for Video Process	May-98	COMPLETED
17306	17360	102-25007	PCM MH Receiver & Formatter	4/92,9/94	COMPLETED
17605		102-25023	IDP/CRT Pwr Switches	Jan-98	COMPLETED
17631		104-25009	Docking Cameras,MIR	6/93,9/93,?,?,2/94	COMPLETED
17631	104-25008 1	104-25012	Shuttle MIR Docking	6/93,9/93,1/94,2/94,11/94,3/95,8/95,9/95	COMPLETED
17909		103-25022	TPS-Del/React AC Sensors	Sep-94	COMPLETED
17914		104-25015	Water Spray Boiler	11/93,6/94,1/95	COMPLETED
17961		103-25015	HLG/NWS Fluid Rtn Path	7/93(WD3/94),3/95	COMPLETED
18099	18888, 10	103-25029	Middeck Pwr Expansion	1/95,8/96,1/97	COMPLETED
18099		103-25034	COMSEC Panel Relocation	Mar-97	COMPLETED
18156		104-25025	TPS Fleet Instrumentation	Jun-97	COMPLETED
18170		103-25051	Orb Propellant Tfer System	Mar-99	IN WORK
18189		103-25017	ISS ODS/Xtnl A/L	8/94,10/94,12/94,2/95,4/95,8/95,11/95,3/9	COMPLETED
18189	103-25031	103-25023	ISSA/ODS CCTV	Sep-94	COMPLETED
18194		104-25016	PCM Prov Mid & Flt Deck	4/94,1/95	COMPLETED
18212	103-25031	103-25021	UHF Space to Space Com	10/94,4/95,5/95,2/96,8/96,1/98,8/98	COMPLETED
18221	18392	103-25020	GOX FCV Perf Enhance	10/95,7/96	COMPLETED
18223		103-25024	Removal OMS/CF HP Bleed	10/94,12/94	COMPLETED
18235		103-25018	Add Nitro Supply	8/94,2/95	NOT INCORPORATED
18256		102-25013	Delete 102 Flipper Door	May-94	COMPLETED
18305		104-25018	Two Temp Hyd Temp Measure	9/94,5/96	COMPLETED
18315		103-25026	Orb SCAR-MPLM Cooling Loop	2/95,10/95,1/96,3/96,6/96	COMPLETED
18315		103-25041	P/L Heat Exc Line Htrs Study	Feb-98	COMPLETED
18349	104-25008 1	104-25012	Shuttle MIR Docking	6/93,9/93,1/94,2/94,11/94,3/95,8/95,9/95	COMPLETED
18349		104-25017	Shuttle MIR Mission	8/94,12/94,3/95,4/95,5/95	COMPLETED

Table 3

D&C PANEL C3 MAIN ENGINE SHUTDOWN SWITCH MARKING ERROR

Presenter:

Organization/Date:
Orbiter/11-19-99

MCR	REF	ECN	TITLE	ECN DATES	STATUS (Schematic Incorporation)
18349		105-25008	Multi MIR Ov 103	8/95,11/95,1/96	COMPLETED
18391		105-25007	KuBand B Redund Deploy Assy	Jul-94	COMPLETED
18392		103-25016	MPS GO2 FCV/SCM	6/95,3/96	COMPLETED
18465		103-25025	Two Stage Vent Valve - ET	Jan-95	COMPLETED
18555		104-25019	GPS Single String	1/95,4/95,4/95,5/95,6/95,8/95	COMPLETED
18556		103-25028	Removal Xtnl Tank Destruct	7/95,7/96	COMPLETED
18605		102-25014	Blk 1 SSME Instr	May-95	COMPLETED
18675		102-25037	OMS Qty Gaging Probe Rem	Oct-98	IN WORK
18695		105-25012	Avionics Bay 3A Cool'g Flow	Jan-97	NOT INCORPORATED
18700		103-25027	Relocation of 15 Measurements	Jul-95	COMPLETED
18722	103-'21&23	103-25031	ISSA Docking Base	11/95,1/96,2/96,6/96,11/96,4/	COMPLETED
18722		105-25009	ISS Dock Base Wiring	2/96,6/96,11/96,4/97	COMPLETED
18774		104-25022	GPS Ins DTO Install 104	11/95,3/96,5/96,11/96	COMPLETED
18846	18928	104-25023	3 String Mgr GPS Impl	96,96,96,97,97,97,11/98	COMPLETED
18849		103-25032	Integration Com Study	1/97,3/97	ON HOLD
18872		102-25016	Cooling Loop Bypass	10/97,1/98,2/99	COMPLETED
18885		103-25033	ODS/OV103 MIR	1/97,11/97	COMPLETED
18885		105-25018	Safing ISS MIR 8 and 9	Oct-97	COMPLETED
18887		102-25015	Solid State Recorder Interfacing	Nov-96	COMPLETED
18905		103-25042	MEDS Util-Telemetry Option 5	Jan-98	ON HOLD
18905	18905	103-25043	MEDS Util-Telemetry Option 1	Jan-98	ON HOLD
18933		104-25026	GPS Ins SIGI Rcvr Avion Bay	Jul-97	COMPLETED
18933		105-25015	GPS SIGI Rcvr Instal	8/97,12/97	COMPLETED
18934		102-25019	Four String IMU Repl w/SIGI	4/97,7/98	ON HOLD
18935		102-25021	Differential GPS (ADLR)	May-97	COMPLETED
18965		104-25024	Cryo Heater Control Fuse	Nov-96	COMPLETED
18980		102-25020	F/C Single Cell-Perf Monitor	6/97,7/97,8/97,10/97	COMPLETED
19008		102-25022	S-Band Pre-amp	May-97	COMPLETED
19016		102-25017	Vert Tail Strain Gauge-MADS	4/97,4/97	COMPLETED
19016		102-25018	Add Rudr/Sped Brake Meas-MAD	4/97,6/97,9/97,10/97	COMPLETED
19029		102-25038	Flt Cntrl Pwr Supply	Nov-98	COMPLETED
19033		102-25035	Orb/ET Umbil Plate Gap Press Xdc	6/98,10/98,3/99	COMPLETED
19038		104-25027	Improved MADS Study	Apr-98	ON HOLD
19046		103-25039	IVHM Heds Tech Demon (HTD)-1	12/97,3/98,1/98,5/98	COMPLETED
19047	UCN19047	105-25019	Repl OVHD Dock&F/W BlkHd Lts	5/98,6/98,11/98,3/99	NOT INCORPORATED
19054		104-25031	Vernier RCS Heater UG	Mar-98	COMPLETED

Table 3

D&C PANEL C3 MAIN ENGINE SHUTDOWN SWITCH MARKING ERROR

Presenter:

Organization/Date:
Orbiter/11-19-99

MCR	REF	ECN	TITLE	ECN DATES	STATUS (Schematic Incorporation)
19088		104-25029	Hydraulic Temp Sen Reloc	2/98,6/98	COMPLETED
19099		102-25025	OMS/RCS Test Point Relocation	2/98,4/98	COMPLETED
19112		105-25016	Wireless Video System	9/97,11/98,2/99	COMPLETED
19116		103-25037	Standard Fluid Interf	Aug-97	COMPLETED
19119		102-25027	Orb Alkaline Fu Cell UG	3/98,12/98,2/99	ON HOLD
19123	19400	102-25026	Solid State Recorder Mass Mmry	3/98,7/98,4/99	IN WORK
19130		105-25017	Fwd Blkhd F/L Coldplate Temp	8/97,11/97,4/98	COMPLETED
19229		104-25030	RMS/ODS Floodlight Redesign	Jan-98	COMPLETED
19239		102-25024	Liquid Flyback Booster-Orbiter	Feb-98	ON HOLD
19258		104-25033	ICS Integ Com Study	Mar-99	COMPLETED
19268		103-25045	ISSA/ODS-Ext A/L Fld Thermal	8/98,8/98	COMPLETED
19274		102-25036	Hydrogen Tank Fuel Meas Study	Aug-98	COMPLETED
19285		102-25029	Removal OMS X-Feed HP Bleed	May-98	COMPLETED
19286		102-25031	OV102 SCAR Wiring for ODS	7/98,7/98,8/98,10/98,1/99	COMPLETED
19303		102-25032	OMS/RCS-Fwd RCS Intercon	Jun-98	ON HOLD
19313		102-25034	102 DFI Wiring Removal	7/98,3/99	COMPLETED
19331		103-25046	ISS/ODS-Wiring TAA Lts,X A/L	9/98,11/98	COMPLETED
19343		103-25047	MPLM Cooling System	Dec-98	COMPLETED
19345		103-25049	Volume D Instll Eng'g	Dec-98	ON HOLD
19347		104-25032	Re-installation of TACANS	Oct-98	COMPLETED
19351		102-25040	Tile Gap Heating OEX Panel	Apr-99	COMPLETED
19362		102-25039	Drag Chute Dr Instrumentation	Dec-98	COMPLETED
19362		103-25048	Drag Chute Dr Instrumentation	1/99,2/99,3/99	COMPLETED
19362		105-25022	Drag Chute Door Instrumentation	2/99,3/99	COMPLETED
19363		102-25041	Three Stg SCAR Instl OV 102	Mar-99	COMPLETED

Table 3

D&C PANEL C3 MAIN ENGINE SHUTDOWN SWITCH MARKING ERROR

Presenter:

Organization/Date:
Orbiter/11-19-99

DOCUMENT	REV	REV_DATE	LAST_EO	EO_DATE	TITLE
VS70-410112	G	08/19/81			SCHEMATIC DIAGRAM-MPS FEED,RECIRCULATION & POGO SUBSYS
VS70-410119	F	07/22/81			SCHEMATIC DIAGRAM-MPS FEED,RECIRCULATION & POGO SUBSYSTEM
VS70-410122	M	03/10/92			SCHEMATIC DIAGRAM-MPS FILL,RELIEF & ET DISCONNECT SUBSYS
VS70-410129	J	03/10/92			SCHEMATIC DIAGRAM-MPS FILL,RELIEF & ET DISCONNECT SUBSYSTEM
VS70-410132	H	01/09/92			SCHEMATIC DIAGRAM-MPS, HE SUBSYSTEM
VS70-410139	E	06/14/89			SCHEMATIC DIAGRAM-MPS,HE SUBSYSTEM
VS70-410142	G	01/16/85			SCHEMATIC DIAGRAM-MPS,SSME INTERFACE SUBSYSTEM
VS70-410149	F	10/14/89			SCHEMATIC DIAGRAM-MPS,SSME INTERFACE SUBSYSTEM
VS70-410152	M	11/01/94			SCHEMATIC DIAGRAM-MPS PANEL INTERFACE SUBSYSTEM
VS70-410159	H	11/01/94			SCHEMATIC DIAGRAM-MPS PANEL INTERFACE SUBSYSTEM
VS70-410162	R	04/15/99			SCHEMATIC DIAGRAM-MPS LIQUID LEVEL & PRESSURIZATION CONT SUBSYS
VS70-410169	P	04/15/99			SCHEMATIC DIAGRAM-MPS LIQUID LEVEL & PRESSURIZATION CONT SUBSYS
VS70-410195	A	11/17/76			SCHEMATIC DIAGRAM MPS FEED,RECIRCULATION & POGO,MPTA
VS70-410298	A	01/12/77			SCHEMATIC DIAGRAM MPS FILL,RELIEF & ET DISCONNECT MPTA
VS70-410398	A	11/30/76			SCHEMATIC DIAGRAM-MPS HE SUBSYSTEM,MPTA
VS70-410498	A	01/18/77			SCHEMATIC DIAGRAM MPS,SSME INTERFACE MPTA SUB-SYSTEM
VS70-410595	A	12/22/76			SCHEMATIC DIAGRAM MPS LIQUID LVL & PRESS CONT SUBSYS MPTA
VS70-420102	J	04/08/98			SCHEMATIC DIAGRAM-RCS SUBSYSTEM CONTROL FORWARD MODULE
VS70-420109	E	04/07/98			SCHEMATIC DIAGRAM-RCS SUBSYSTEM CONTROL FORWARD MODULE
VS70-420202	G	04/28/98			SCHEMATIC DIAGRAM-AFT RCS SUBSYSTEM CONTROL RIGHT OMS POD
VS70-420203	E	04/24/98			SCHEMATIC DIAGRAM-AFT RCS SUBSYSTEM CONTROL RIGHT OMS POD
VS70-420209	D	04/24/98			SCHEMATIC DIAGRAM-AFT RCS SUBSYSTEM CONTROL RIGHT OMS POD
VS70-420302	H	04/23/98			SCHEMATIC DIAGRAM-AFT RCS SUBSYSTEM CONTROL LEFT OMS POD
VS70-420303	D	04/23/98			SCHEMATIC DIAGRAM-AFT RCS SUBSYSTEM CONTROL LEFT OMS POD
VS70-420309	E	04/24/98			SCHEMATIC DIAGRAM-AFT RCS SUBSYSTEM CONT LEFT OMS POD
VS70-430202	G	04/23/98			SCHEMATIC DIGRAM-OMS SUBSYSTEM CONTROL RIGHT POD
VS70-430209	D	04/23/98			SCHEMATIC DIAGRAM - OMS SUBSYSTEM CONTROL RIGHT POD
VS70-430302	K	11/18/98			SCHEMATIC DIAGRAM-OMS SUBSYSTEM CONTROL LEFT POD
VS70-430309	K	04/23/98			SCHEMATIC DIAGRAM - OMS SUBSYSTEM CONTROL LEFT POD
VS70-430402	A	05/20/81			SCHEMATIC DIAGRAM-OMS SUBSYSTEM CONTROL OMS KIT
VS70-430409	NC	05/27/81			SCHEMATIC DIAGRAM-OMS SUBSYSTEM CONTROL OMS KIT
VS70-450101	B	11/05/75	C02	07/02/76	SCHEMATIC DIAGRAM-FUEL CELL CONTROL SUBSYSTEM
VS70-450102	E	03/16/82			SCHEMATIC DIAGRAM-FUEL CELL CONTROL SUBSYSTEM
VS70-450105	C	11/26/95			SCHEMATIC DIAGRAM - FUEL CELL CONTROL SUBSYSTEM
VS70-450109	F	12/06/83			SCHEMATIC DIAGRAM-FUEL CELL CONTROL SUBSYSTEM
VS70-450112	G	03/07/91			SCHEMATIC DIAGRAM-FUEL CELL CONTROL SUBSYSTEM
VS70-450119	C	03/26/91			SCHEMATIC DIAGRAM-FUEL CELL CONTROL SUBSYSTEM
VS70-450122	A	11/26/95			FUEL CELL CONTROL
VS70-450129	A	12/13/95			SCHEMATIC DIAGRAM-FUEL CELL CONTROL SUBSYSTEM
VS70-450201	C	02/12/76	D02	07/02/76	SCHEMATIC DIAGRAM _ HI PRESSURE GAS
VS70-450202	G	07/17/81			SCHEMATIC DIAGRAM-CRYO SUBSYSTEM
VS70-450205	C	12/05/96			SCHEMATIC DIAGRAM - CRYO SUBSYSTEM
VS70-450209	F	03/30/84			SCHEMATIC DIAGRAM-CRYO SUBSYSTEM
VS70-450212	D	06/05/91			SCHEMATIC DIAGRAM - CRYO SUBSYSTEM
VS70-450219	F	12/05/96			SCHEMATIC DIAGRAM-CRYO SUBSYSTEM
VS70-450222	B	10/24/83			SCHEMATIC DIAGRAM - CRYO SUBSYSTEM
VS70-450242	E	12/04/96			(VAX) SCHEMATIC DIAG - EDO 16 DAY CRYO MISSION EXTENSION SUBSYS
VS70-450244	A	11/14/95			(VAX)SCHEMATIC DIAGRAM-LDO-25 DAY CRYO MISSION EXTENTION SUBSY'
VS70-450245	B	11/21/95			(VAX) SCHEMATIC DIAGRAM-EDO-28 DAY CRYO MISSION EXT SUBSYSTEM
VS70-460003	C	10/22/81			INTEGRATED SCHEMATIC DIAGRAM-APU SUBSYS INTEGRATED TEST'
VS70-460101	E	03/03/76	F01	07/02/76	SCHEMATIC DIAGRAM-AUXILIARY PROPULSION UNIT SUBSYSTEM
VS70-460102	Y	10/25/94			SCHEMATIC DIAGRAM-AUXILARY POWER UNIT SUBSYSTEM
VS70-460103	B	10/26/94			SCHEMATIC DIA - APU SUBSYSTEM
VS70-460105	F	11/01/94			SCHEM DIAG-AUXILIARY POWER UNIT SUBSYSTEM
VS70-460109	M	02/22/90			SCHEMATIC DIAGRAM-AUXILIARY POWER UNIT SUBSYSTEM
VS70-510101	E	07/02/76	F01	07/29/77	SCHEMATIC DIAGRAM-LANDING GEAR CONTROL SUBSYSTEM
VS70-510102	T	04/13/95			SCHEMATIC DIAGRAM-LANDING GEAR CONTROLS SUBSYSTEM
VS70-510109	P	07/14/97			SCHEMATIC DIAGRAM - LANDING GEAR CONTROLS SUBSYSTEM
VS70-510201	E	06/15/76	F03	08/15/77	SCHEMATIC DIAGRAM-NOSE WHEEL STEERING
VS70-510202	F	08/20/84			SCHEMATIC DIAGRAM - NOSE WHEEL STEERING SUBSYSTEM
VS70-510303	B	10/10/91			SCHEM DIAG - NOSE WHEEL STEERING SUBSYSTEM
VS70-510209	E	06/22/85			SCHEMATIC DIAGRAM-NOSE WHEEL STEERING SUBSYSTEM
VS70-510219	B	05/09/89			SCHEMATIC DIAGRAM-NOSE WHEEL STEERING SUBSYSTEM
VS70-510302	E	03/22/90			SCHEMATIC DIAGRAM-NOSE WHEEL STEERING SUBSYSTEM
VS70-520101	D	02/12/76	E02	08/01/77	SCHEMATIC DIAGRAM-ANTI-SKID & BRAKES SUBSYSTEM
VS70-520102	P	05/11/92			SCHEMATIC DIAGRAM-BRAKE & SKID CONTROL SUBSYSTEM
VS70-520109	N	06/05/92			SCHEMATIC DIAGRAM - BRAKE & SKID CONTROL SUBSYSTEM
VS70-520202	A	08/01/91			(VAX)SCHEMATIC DIAGRAM - DRAG CHUTE CONTROL SUBSYSTEM
VS70-520203	D	08/01/91			(VAX) SCHEMATIC DIAGRAM-DRAG CHUTE CONTROL SUBSYSTEM
VS70-540044	D	02/02/90			(U)SCHEMATIC DIAGRAM PAYLOAD RETENTION SUBSYS(STS-38)
VS70-540079	A	02/16/83			(CAD)SCHEMATIC DIAGRAM-PAYLOAD RETENTION SUBSYS(STS-7)
VS70-540052	F	02/26/91			(VAX) SCHEMATIC DIAGRAM - PAYLOAD RETENTION SUBSYS (STS-45)

Table 4

D&C PANEL C3 MAIN ENGINE SHUTDOWN SWITCH MARKING ERROR

Presenter:

Organization/Date:
Orbiter/11-19-99

DOCUMENT	REV	REV_DATE	LAST_EO	EO_DATE	TITLE
VS70-540113	S	03/13/91			(VAX)SCHEMATIC DIAGRAM - P/L RETENTION SUBSYS (STS-48)
VS70-540114	D	05/20/92			(VAX) SCHEMATIC DIAGRAM-PAYLOAD RETENTION SUBSYS (STS-57)
VS70-540115	C	07/14/93	D01	03/07/94	(VAX) SCHEMATIC DIAGRAM-PAYLOAD RETENTION SUBSYS (STS-59)
VS70-540119	B	06/10/83			(CAD) SCHEMATIC DIAGRAM-PAYLOAD RETENTION SUBSYS (STS-11'
VS70-540122	E	12/13/85			(CAD)SCHEMATIC DIAGRAM-PAYLOAD RETENTION SUBSYS(MV0746)
VS70-540123	NC	12/21/82			(CAD)SCHEMATIC DIAGRAM-PAYLOAD RETENTION SUBSYS(STS-12)
VS70-540124	G	06/12/92			(VAX)SCHEM DIAG - PAYLOAD RETENTION SUBSYSTEM (STS 46)
VS70-540132	C	11/27/85			(CAD)SCHEMATIC DIAGRAM-PAYLOAD RETENTION SUBSYS PAY'
VS70-540133	NC	07/11/90			(VAX) SCHEMATIC DIAGRAM - PAYLOAD RETENTION SUBSYS (STS-49)
VS70-540134	NC	05/19/84			(VAX) SCHEMATIC DIAGRAM PAYLOAD RETENTION SYSBYS (STS-71)
VS70-540135	A	02/19/85			(CAD) SCHEMATIC DIAGRAM-PAYLOAD RETENTION SUBSYS (MV07'
VS70-540139	A	06/17/83			(CAD) SCHEMATIC DIAGRAM-PAYLOAD RETENTION SUBSYS (OV-099'
VS70-540142	C	06/02/86			(CAD) SCHEMATIC DIAGRAM-PAYLOAD RETENTION SUBSYS (MV0749)
VS70-540143	D	05/03/84			(CAD) SCHEMATIC DIAGRAM-PAYLOAD RETENTION SUBSYS (STS-14)
VS70-540144	A	03/21/89			(U)SCHEMATIC DIAGRAM PAYLOAD RETENTION SUBSYS (STS-33)(U)
VS70-540145	NC	07/12/84			(CAD) SCHEMATIC DIAGRAM-PAYLOAD RETENTION SUBSYS (STS-14'
V870-540152	NC	12/18/87			(U) SCHEMATIC DIAGRAM-PAULOAD RETENTION SUBSYS (STS-28)
VS70-540153	NC	07/22/91			(CAD) SCHEMATIC DIAGRAM - PAYLOAD RETENTION SUBSYS (STS-53)
VS70-540154	C	07/28/95			(VAX) SCHEMATIC DIAGRAM PAYLOAD RETENTION SUBSYS (STS-74)
VS70-540155	C	09/15/83			(VAX) SCHEMATIC DIAGRAM-PAYLOAD RETENTION SUBSYS (STS-61)
VS70-540162	D	08/22/89			(VAX) SCHEMATIC DIAGRAM-PAYLOAD RETENTION SUBSYS (STS-32)
VS70-540163	E	07/27/84			(CAD)SCHEMATIC DIAGRAM-PAYLOAD RETENTION SUBSYS(STS-16)
VS70-540164	B	08/14/95			(VAX) SCHEMATIC DIAGRAM PAYLOAD RETENTION SUBSYS (STS-76)
VS70-540165	C	02/24/94	D01	03/11/94	(VAX) SCHEMATIC DIAGRAM PAYLOAD RETENTION SUBSYS (STS-66)
VS70-540172	D	08/12/90			(VAX)SCHEMATIC DIAGRAM-PAYLOAD RETENTION SUBSYSTEMS (STS-35)
VS70-540173	D	08/28/84			(CAD) SCHEMATIC DIAGRAM-PAYLOAD RETENTION SUBSYS (STS-17)
VS70-540174	A	10/16/95			(VAX)SCHEMATIC DIAGRAM PAYLAOD RETENTION SUBSYS (STS-79)
VS70-540175	C	02/24/95			(VAX) SCHEMATIC DIAGRAM PAYLOAD RETENTION SUBSYS (STS-69)
VS70-540182	C	10/23/90			(VAX) SCHEMATIC DIAGRAM PAYLOAD RETENTION SUBSYS (STS-37)
VS70-540183	C	09/28/90			(VAX)SCHEM DIAG PAYLOAD RETENTON SYBSYSTEM (STS-41)
VS70-540184	NC	12/13/95			(VAX) SCHEMATIC DIAGRAM-PAYLOAD RETENTION SUBSYS (STS-81)
VS70-540188	B	08/24/90			(VAX) SCHEMATIC DIAGRAM-PAYLOAD RETENTION SUBSYS (STS-40)
VS70-540189	K	11/22/85			(CAD) SCHEMATIC DIAGRAM-PAYLOAD RETENTION SUBSYS(51-L)
VS70-540192	C	03/03/92			(VAX) SCHEMATIC DIAGRAM - PAYLOAD RETENTION SUBSYS (STS-50)
VS70-540193	D	07/27/84			(CAD)SHEMATIC DIAGRAM-PAYLOAD RETENTION SUBSYS(STS-19)
VS70-540194	NC	07/23/96			(VAX) SCHEMATIC DIAGRAM PAYLOAD RET. SUBSYSTEMS (STS-84)
VS70-540195	A	08/29/84			(CAD)SCHEMATIC DIAGRAM-PAYLOAD RETENTION SUBSYS(STS-19 '
VS70-540199	A	10/15/90			(VAX)SCHEM DIAG - PL RTN SUBSYS (STS-39)
VS70-540202	K	04/28/95			(CATIA)SCHEMATIC DIAGRAM-PAYLOAD RETENTION,SUBSYSTEM
VS70-540203	D	07/16/93			(VAX) SCHEMATIC DIAGRAM-PAYLOAD RETENTION SUBSYS (STS-60)
VS70-540205	B	06/22/96			(VAX) SCHEMATIC DIAGRAM-PAYLOAD RETENTION SUBSYS (STS-77)
VS70-540209	H	04/28/95			SCHEMATIC DIAGRAM-PAYLOAD RETENTION SUBSYSTEM
VS70-540212	NC	06/25/86			SCHEMATIC DIAGRAM-PAYLOAD RETENTION SUBSYS(VLS0001)
VS70-540213	A	12/07/93			(VAX) SCHEMATIC DIAGRAM - PAYLOAD RETENTION SUBSYS (STS-63)
VS70-540214	B	05/08/97			(VAX)SCHEMATIC DIAGRAM PAYLOAD RETENTION SUBSYS (STS-86)
VS70-540215	NC	09/18/96	A02	11/13/98	(VAX)SCHEMATIC DIAGRAM PAYLOAD RETENTION SUBSYS (STS-88)
VS70-540222	H	06/16/87			(CAD) SCHEMATIC DIAGRAM - PAYLOAD RETENTION SUBSYSTEM
VS70-540223	NC	07/26/88			SCHEMATIC DIAGRAM PAYLOAD RETENTION SUBSYS (STS-34)
VS70-540224	NC	11/24/97			(VAX) SCHEMATIC DIAGRAM PAYLOAD RETENTION SUBSYSTEM (STS 92)
VS70-540225	C	12/08/98			(CAT(A)SCHEMATIC DIAGRAM PAYLOAD RETENTION SUBSYS (STS-96)
VS70-540229	C	04/01/85			(CAD) SCHEMATIC DIAGRAM-PAYLOAD RETENTION SUBSYS (51-D)
VS70-540232	NC	09/14/82			(CAD) SCHEMATIC DIAGRAM PAYLOAD RETENTION SUBSYS (NASA/'
VS70-540233	C	05/29/84			(CAD) SCHEMATIC DIAGRAM PAYLOAD RETENTION SUBSYS (STS-22)
VS70-540239	A	05/10/82			(CAD) SCHEMATIC DIAGRAM-PAYLOAD RETENTION SUBSYS (NASA/'
VS70-540242	NC	01/23/84			(CAD) SCHEMATIC DIAGRAM-PAYLOAD RETENTION SUBSYS (STS-24)
VS70-540243	D	07/28/94			(VAX)SCHEMATIC DIAGRAM PAYLOAD RETENTION SUBSYSTEM (STS-64)
VS70-540244	C	09/12/88			(U) SCHEMATIC DIAGRAM - PAYLOAD RETENTION SUBSYS (STS-27)
VS70-540249	B	02/18/83			(CAD)SCHEMATIC DIAGRAM-PAYLOAD RETENTION SUBSYS(STS-6/IUS
VS70-540252	C	12/12/85			(CAD)SCHEMATIC DIAGRAM-PAYLOAD RETENTION SUBSYS (61-H)
VS70-540253	D	01/19/89			(VAX) SCHEMATIC DIAGRAM PAYLOAD RETENTION SUBSYS (STS-29)
VS70-540254	G	04/24/85			(CAD)SCHEMATIC DIAGRAM-PAYLOAD RETENTION SUBSYS 51-G
VS70-540259	B	01/27/86			(CAD) SCHEMATIC DIAGRAM-PAYLOAD RETENTION SUBSYS (61-I)
VS70-540262	A	01/06/86			(CAD)SCHEMATIC DIAGRAM-PAYLOAD RETENTION SUBSYS(MV074-0'
VS70-540263	A	10/13/94			(VAX) SCHEMATIC DIAGRAM PAYLOAD RETENTION (STS-70) SUBSYSTEM
VS70-540264	F	03/01/88			(CAD) SCHEMATIC DIAGRAM-PAYLOAD RETENTION SUBSYS (STS-31)
VS70-540272	B	03/04/86			(CAD) SCHEMATIC DIAGRAM-PAYLOAD RETENTION SUBSYS (61-K)
VS70-540273	NC	01/17/96			(VAX) SCHEMATIC DIAGRAM PAYLOAD RETENTION SUBSYS (STS-82)
VS70-540274	E	07/08/85			(CAD)SCHEMATIC DIAGRAM-PAYLOAD RETENTION SUBSYS'
VS70-540279	J	09/15/88			(VAX)SCHEMATIC DIAGRAM PAYLOAD RETENTION SUBSYS (STS-28)
VS70-540282	B	06/25/86			(CAD)SCHEMATIC DIAGRAM-PAYLOAD RETENTION SUBSYS(MV0-747)
VS70-540283	B	02/25/97			(VAX) SCHEMATIC DIAGRAM PAYLAOD RETENTION SUBSYS (STS-85
VS70-540284	B	03/04/86			(CAD)SCHEMATIC DIAGRAM-PAYLOAD RETENTION SUBSYS(61-L)

Table 4

D&C PANEL C3 MAIN ENGINE SHUTDOWN SWITCH MARKING ERROR

Presenter:

Organization/Date:
Orbiter/11-19-99

DOCUMENT	REV	REV_DATE	LAST_EO	EO_DATE	TITLE
VS70-540352	A	01/08/86			(CAD)SCHEMATIC DIAGRAM-PAYLOAD RETENTION SUBSYS (71-A)
VS70-540362	NC	02/19/86			(CAD)SCHEMATIC DIAGRAM-PAYLOAD RETENTION SUBSYS (71-C)
VS70-540372	A	07/16/93			(VAX) SCHEMATIC DIAGRAM-PAYLOAD RETENTION SUBSYS (STS-62)
VS70-540379	C	05/14/86			(CAD) SCHEMATIC DIAGRAM-PAYLOAD RETENTION SUBSYS (61-F)
VS70-540382	NC	06/09/93			(VAX) SCHEMATIC DIAGRAM-PAYLOAD RETENTION SUBSYS (STS-65)
VS70-540384	B	12/13/85			(CAD) SCHEMATIC DIAGRAM-PAYLOAD RETENTION SUBSYS (STS-36)
VS70-540392	C	12/06/94	B01	04/04/94	(VAX) SCHEMATIC DIAGRAM PAYLOAD RETENTION SUBSYSTEM (STS-67)
VS70-540402	K	08/23/85			SCHEMATIC DIAGRAM-STARBD MANIP DEPLMT CONTROL SUBSYSTEM
VS70-540409	E	06/19/84			SCHEMATIC DIAGRAM-STARBOARD MANIP DEPLMT CONTROL SUB*
VS70-540412	NC	10/19/94			(VAX) SCHEMATIC DIAGRAM PAYLOAD RETENTION SUBSYS (STS-73)
VS70-540419	C	07/08/85			(CAD) SCHEMATIC DIAGRAM-PAYLOAD RETENTION SUBSYS(STS-30)
VS70-540422	NC	04/27/95			(VAX)SCHEMATIC DIAGRAM PAYLOAD RETENTION SUBSYS (STS-75)
VS70-540432	NC	08/07/95			(VAX)SCHEMATIC DIAGRAM PAYLOAD RETENTION SUBSYS (STS-76)
VS70-540442	C	08/23/85			SCHEMATIC DIAGRAM-STARBOARD MANIP DEPLMT CONTROL SUBSYST*
VS70-540449	B	04/14/86			SCHEMATIC DIAGRAM-STARBD MANIP DEPLMT CONTROL SUBSYSTEM
VS70-540452	B	06/06/96			SCHEMATIC DIAGRAM-PAYLOAD RETENTION SUBSYS (STS-80)
VS70-540462	A	05/15/97			(VAX) SCHEMATIC DIAGRAM PAYLOAD RETENTION SUBSYS (STS-83)
VS70-540472	C	04/17/97			(VAX) SCHEMATIC DIAGRAM - PAYLOAD RETNETION SUBSYSTEM (STS-87)
VS70-540482	NC	04/08/97			(VAX) SCHEMATIC DIAGRAM - PAYLOAD RETENTION SUBSYS (STS-90)
VS70-540492	A	11/06/97			(VAX)SCHEMATIC DIAGRAM PAYLOAD RETENTION SUBSYS (STS-93)
VS70-540502	H	04/16/84			SCHEMATIC DIAGRAM-PORT MANIPULATOR DEPLMT CONT SUBSYSTEM
VS70-540509	B	05/25/84			SCHEMATIC DIAGRAM-PORT MANIPULATOR DEPLMT CONTROL*
VS70-540512	B	06/22/84			SCHEMATIC DIAGRAM-PORT MANIPULATOR DEPLMT CONT SUBSYSTEM
VS70-540519	A	05/25/84			SCHEMATIC DIAGRAM-PORT MANIPULATOR DEPLMT CONTROL SUBSYS*
VS70-540552	B	05/17/85			SCHEMATIC DIAGRAM-REMOTE MANIPULATOR ARM SYBSYSTEM
VS70-540559	NC	02/16/84			SCHEMATIC DIAGRAM-REMOTE MANIPULATOR ARM SYBSYSTEM
VS70-540602	H	06/10/81			SCHEMATIC DIAGRAM-STARBD MANIP RETTN LATCH CONTROL SUB *
VS70-540609	C	03/03/83			SCHEMATIC DIAGRAM-STARBD MANIP RETTN LATCH CONTROL SUB *
VS70-540702	L	05/16/84	J01	08/10/81	SCHEMATIC DIAGRAM-PORT MANIP RETTN LATCH CONT SUBSYSTEM
VS70-540709	A	03/25/81			SCHEMATIC DIAGRAM-PORT MANIP RETTN LATCH CONTROL SUB*
VS70-540802	D	06/21/80			SCHEMATIC DIAGRAM-STARBD MANIP ARM SHLDR JTSN&RETTN LCH*
VS70-540809	C	04/23/87			SCHEMATIC DIAGRAM STARBD MANIP ARM SHLDR JTSN & RETTN*
VS70-540822	A	03/24/83			SCHEMATIC DIAGRAM STARBD MANIP ARM SHLDR JTSN & RETTN *
VS70-540902	D	05/17/80			SCHEMATIC DIAGRAM-PORT MANIP ARM SHLDR JTSN&RETTN *
VS70-540909	A	02/02/83			SCHEMATIC DIAGRAM-PORT MANIP ARM SHLDR JTSN & RETTN LCH*
VS70-540922	B	03/24/83			SCHEMATIC DIAGRAM-PORT MANIP ARM SHLDR JTSN & RETTN LCH *
VS70-540953	NC	02/21/84			SCHEMATIC DIAGRAM-PAYLOAD RETENTION SUBSYS (STS-19 OPT*
VS70-560102	G	10/27/83			SCHEMATIC DIAGRAM-EXTERNAL TANK DOORS CONTROL SUB-SYSTEM
VS70-560109	C	11/07/83			SCHEMATIC DIAGRAM-EXTERNAL TANK DOORS CONTROL SUB-SYSTEM
VS70-560112	E	04/03/97			SCHEMATIC DIAGRAM-EXTERNAL TANK DOORS CONTROL SUB-SYSTEM
VS70-560119	E	04/04/97			SCHEMATIC DIAGRAM-EXTERNAL TANK DOORS CONTROL SUB-SYSTEM
VS70-580098	C	08/17/76			SCHEMATIC DIAGRAM-HYDRAULIC CONTROL MPTA
VS70-580101	J	08/23/77	G01	07/02/76	SCHEMATIC DIAGRAM-HYDRAULIC CONTROL SUBSYSTEM
VS70-580102	T	10/21/94			SCHEMATIC DIAGRAM-HYDRAULIC CONTROL SUBSYSTEM
VS70-580109	L	10/25/94			SCHEMATIC DIAGRAM-HYDRAULIC CONTROL SUBSYSTEM
VS70-580112	H	07/27/84			SCHEMATIC DIAGRAM-WATER SPRAY BOILER NO 1,2,3
VS70-580119	H	01/31/94			SCHEMATIC DIAGRAM-WATER SPRAY BOILER NO.1,2,3
VS70-580122	E	01/31/94			(VAX)SCHEMATIC DIAGRAM-WATER SPRAY BOILERS 1,2 & 3 SUBSY*
VS70-590102	E	03/29/84			SCHEMATIC DIAGRAM-KU BAND ANTENNA DEPLOYMENT
VS70-590109	C	07/26/83			SCHEMATIC DIAGRAM-KU BAND ANTENNA DEPLOYMENT
VS70-590112	A	11/27/85			SCHEMATIC DIAGRAM-KU BAND ANTENNA DEPLOYMENT
VS70-590119	B	12/03/85			SCHEMATIC DIAGRAM-KU BAND ANTENNA DEPLOYMENT
VS70-590202	E	04/05/83			SCHEMATIC DIAGRAM-STAR TRACKER DOOR ACTUATOR SUBSYSTEM
VS70-590209	A	04/05/83			SCHEMATIC DIAGRAM-STAR TRACKER DOOR ACTUATOR SUBSYSTEM
VS70-590301	C	07/02/76	D01	07/28/77	SCHEMATIC DIAG-AIR DATA PROBE DEPLOYMENT&HTR CONT SUBSYS
VS70-590302	E	08/14/91			SCHEMATIC DIAGRAM-AIR DATA PROBE DEPLOYMENT & HEATER
VS70-590309	B	12/10/91			SCHEMATIC DIAGRAM-AIR DATA PROBE DEPLOYMENT AND HAETER
VS70-590402	H	08/20/83			SCHEMATIC DIAGRAM-FREON RADIATOR DEPLOYMENT SUBSYSTEM
VS70-590409	B	05/20/93			SCHEMATIC DIAGRAM-FREON RADIATOR DEPLOYMENT SUBSYS
VS70-590502	G	04/22/91			SCHEMATIC DIAGRAM-ACTIVE VENT DOOR SUBSYSTEM
VS70-590509	F	04/18/91			SCHEMATIC DIAGRAM - ACTIVE VENT DOOR SUBSYSTEM
VS70-590598	C	11/23/76			SCHEMATIC DIAGRAM-MPTA AFT VENT SYSTEM
VS70-590602	A	03/22/78			SCHEMATIC DIAGRAM-CREW INGRESS/EGRESS,HATCH LATCH *
VS70-590609	NC	11/19/80			SCHEMATIC DIAGRAM-CREW INGRESS/EGRESS, HATCH LATCH*
VS70-610101	S	02/12/76	C02	07/29/77	SCHEMATIC DIAGRAM-ATMOSPHERIC REVITALIZATION SUBSYSTEM
VS70-610102	J	04/15/86			SCHEMATIC DIAGRAM-ATMOSPHERIC REVITALIZATION SUBSYSTEM
VS70-610105	NC	05/06/86			SCHEMATIC DIAGRAM-ATM REVITALIZATION SUBSYSTEM
VS70-610109	E	04/23/85			SCHEMATIC DIAGRAM - ATMOSPHERIC REVITALIZATION SUBSYSTEM
VS70-610202	T	01/05/93			SCHEMATIC DIAGRAM-ATMOSPHERE REVITALIZATION & PRESSURE *
VS70-610205	B	12/18/92			SCHEMATIC DIAGRAM-ATMOSPHERE REVITALIZATION & PRESS CONT SYSTEM
VS70-610209	H	12/18/92			SCHEMATIC DIAGRAM-ATMOSPHERE REVITALIZATION & PRESS CONT SYSTEM
VS70-610302	D	01/15/93			(VAX)SCHEMATIC DIAGRAM - C02 REMOVAL SUBSYSTEM

Table 4

D&C PANEL C3 MAIN ENGINE SHUTDOWN SWITCH MARKING ERROR

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DOCUMENT	REV	REV_DATE	LAST_EO	EO_DATE	TITLE
VS70-640102	E	09/05/80			SCHEMATIC DIAGRAM-AIRLOCK ENVIRONMENTAL CONT SUBSYSTEM
VS70-640109	E	09/12/97			(VAX) SCHEMATIC DIAGRAM - AIRLOCK ENVIRONMENTAL CONT SUBSYSTEM
VS70-660912	C	07/15/85			SCHEMATIC DIAGRAM-MMU-FSS PORT SUBSYSTEM
VS70-660919	A	12/22/83			SCHEMATIC DIAGRAM-MMU-FSS PORT SUBSYS
VS70-660922	C	07/15/85			SCHEMATIC DIAGRAM-MMU-FSS STARBOARD SUBSYS
VS70-660929	A	12/22/83			SCHEMATIC DIAGRAM-MMU-FSS STARBOARD SUBSYS
VS70-710101	B	03/12/75			SCHEMATIC DIAGRAM-INERTIAL MEAS UNIT(IMU)G/N SUBSYSTEM
VS70-710102	D	03/28/83			SCHEM DIAG-INRTL MEASUREMENT UNIT (IMU)G/N SUBSYSTEM
VS70-710109	NC	11/19/80			SCHEMATIC DIAGRAM-INERTIAL MEASUREMENT UNIT (IMU)
VS70-710121	D	09/06/75			SCHEMATIC DIAGRAM-AIR DATA TRANSDUCER SUBSYSTEM
VS70-710122	C	01/19/83			SCHEMATIC DIAGRAM AIR DATA TRANSDUCER SUB-SYSTEM
VS70-710129	A	01/19/83			SCHEMATIC DIAGRAM AIR DATE TRANSDUCER SUB-SYSTEM
VS70-710131	J	05/04/77			SCHEMATIC DIAGRAM-AIR DATA COMP,BACKUP FLT CONT SUBSYS
VS70-710142	D	04/03/86			SCHEMATIC DIAGRAM-STAR TRACKER
VS70-710149	A	04/03/86			SCHEMATIC DIAGRAM-STAR TRACKER
VS70-710152	E	01/23/81			SCHEMATIC DIAGRAM-ORBITER RATE GYRO GDNC & NAV SYSTEM
VS70-710159	B	08/04/83			SCHEMATIC DIAGRAM-ORBITER RATE GYRO GDNC & NAV SYSTEM
VS70-710172	J	01/05/93			SCHEMATIC DIAGRAM-SOLID RKT BSTR RATE GYRO GDNC & NAV SYS
VS70-710179	E	08/26/91			SCHEMATIC DIAGRAM-SOLID RKT BSTR RATE GYRO GDNC & NAV SUBSYSTEM
VS70-720198	C	10/12/76			SCHEMATIC DIAGRAM ENGINE INTRFACE UNIT/MAIN PROPULSION*
VS70-720201	D	06/02/76	E01	07/29/77	SCHEMATIC DIAGRAM-DATA PROC &SOFTWARE,FLT CONT MDM PWR &*
V870-720202	F	04/11/96			SCHMATIC DIAGRAM-DATA PROC & SOFTWARE,FLT CONT MDM PWR &*
VS70-720209	E	04/11/96			SCHEMATIC DIAGRAM-DATA PROC & SOFTWARE,FLT CONT MDM PWR*
VS70-720211	C	03/31/76	D01	07/02/76	SCHEMATIC DIAGRAM-MASS MEMORY&COMPUTER INTERFACE SUB*
VS70-720212	F	07/27/92			SCHEMATIC DIAGRAM-MASS MEMORY & COMPUTER INTERFACE SUBSYS
VS70-720219	B	11/21/88			SCHEMATIC DIAGRAM MASS MEMORY & COMPUTER INTERFACE SUBSYSTEM
VS70-720221	D	07/02/76	D01	07/02/76	SCHEMATIC DIAGRAM- COMPUTER PWR & CONTROLS SUBSYSTEM
VS70-720222	K	07/27/92			SCHEMATIC DIAGRAM-COMPUTER PWR & CONTROLS SUBSYSTEM
VS70-720229	D	09/16/88			SCHEMATIC DIAGRAM-COMPUTER PWR & CONTROLS SUBSYSTEM
VS70-720231	B	04/30/76	C01	07/02/76	SCHEMATIC DIAGRAM-COMPUTER SYNCHRONIZATION AND FAIL STAT*
VS70-720232	D	07/27/92			SCHEMATIC DIAGRAM-COMPUTER SYNCHRONIZATION AND FAIL STA*
VS70-720239	B	09/15/88			SCHEMATIC DIAGRAM-CMPTR SYNCHRONIZATION AND FAIL STATUS
VS70-720241	C	04/15/76			SCHEMATIC DIAGRAM-COMPUTER DATA BUS INTERFACE SUBSYSTEM
VS70-720242	C	07/27/92			SCHEMATIC DIAGRAM-COMPUTER DATA BUS INTERFACE SUBSYSTEM
VS70-720251	A	10/24/75	B01	07/01/76	SCHEMATIC DIAGRAM-COMPUTER IOP/CPU INTERFACE SUBSYSTEM
VS70-720252	NC	07/22/75			SCHEMATIC DIAGRAM-COMPUTER IOP/CPU INTERFACE SUBSYSTEM
VS70-720259	A	11/10/88			SCHEMATIC DIAGRAM-COMPUTER IOP/CPU INTERFACE SUBSYSTEM
VS70-720262	K	11/18/96			SCHEMATIC DIAGRAM-BACK UP FLT CONT COMPUTER INTERFACE *
VS70-720269	G	11/15/96			SCHEMATIC DIAGRAM-BACK UP FLT CONT COMPUTER INTERFACE *
VS70-720302	G	08/31/83			SCHEMATIC DIAGRAM-ENGINE INTERFACE UNIT DPS SUB-SYSTEM
VS70-720309	F	08/31/83			SCHEMATIC DIAGRAM - ENGINE INTFC UNIT DPS SUB-SYSTEM
VS70-720401	B	04/13/76			SCHEMATIC DIAGRAM-PAYLOAD MDM FUNTIONAL INTERFACE
VS70-720501	NC	10/25/74			SCHEMATIC BLOCK DIAGRAM-DATA PROCESSING & SOFTWARE**
VS70-720502	B	04/10/79			SCHEMATIC BLOCK DIAGRAM-DATA PROCESSING & SOFTWARE FU*
VS70-720511	C	04/20/76	D01	07/01/76	SCHEMATIC DIAGRAM-INTER-COMPUTER DATA BUS IC801 TH IC804
VS70-720512	C	07/27/92			SCHEMATIC DIAGRAM-INTER-COMPUTER DATA BUS IC801 THUR IC8*
VS70-720519	C	10/06/88			SCHEMATIC DIAGRAM-INTER COMPUTER DATA BUS IC801 THRU IC805
VS70-720521	C	04/13/76	D01	07/02/76	SCHEMATIC DIAGRAM-DP&S DATA BUSES OI-1 AND OI-2
VS70-720522	D	03/30/83			SCHEMATIC DIAGRAM-DP & S DATA BUS OI-1 & OI-2
VS70-720529	NC	10/16/80			SCHEMATIC DIAGRAM-DP & S DATA BUS OI-1 & OI-2
VS70-720531	C	04/13/76	D01	07/02/76	SCHEMATIC DIAGRAM-DATA BUSES IP1 THRU IP5
VS70-720532	B	03/29/78			SCHEMATIC DIAGRAM-DATA BUS IP1 THRU IP5
VS70-720539	A	11/11/88			SCHEMATIC DIAGRAM - DATA BUS IP1 THRU IP5
VS70-720541	C	04/13/76	D01	07/02/76	SCHEMATIC-WIRING DP AND S DATA BUS BUB01,BUB05 TH BUB08
VS70-720542	B	01/20/83			SCHEMATIC DIAGRAM-DP AND S DATA BUSES PI1 AND PI2
VS70-720549	NC	11/26/80			SCHEMATIC DIAGRAM-DP AND S DATA BUSES PI 1 AND PI 2
VS70-720551	C	04/16/76	D01	07/02/76	SCHEMATIC DIAGRAM-DATA BUS LBB01 & LBB02
VS70-720552	G	03/15/91			SCHEMATIC DIAGRAM-DATA BUS LBB01 & LBB02
VS70-720559	D	11/11/93			SCHEMATIC DIAGRAM-DATA BUS LBB01 & LBB02
VS70-720561	C	04/14/76	D01	07/02/76	SCHEMATIC DIAGRAM-DP&S DATA BUSES FC1,FC2,FC3,FC4,FC5,*
VS70-720562	H	03/02/95			SCHEMATIC DIAGRAM-DP&S DATA BUSES FC 1,2,3,4,5,6,7,8 &
VS70-720569	C	04/04/95			SCHEMATIC DIAGRAM - DP&S DATA BUSES FC 1,2,3,4,5,6,7&8
VS70-720571	C	04/15/76	D01	07/02/76	SCHEMATIC DIAGRAM-DP AND S DATA BUSES DK1,DK2 AND DK3
VS70-720572	C	02/23/95			SCHEMATIC DIAGRAM DP AND S DATA BUSES DK1,DK2,DK3 AND DK4
VS70-720579	B	02/23/95			SCHEMATIC DIAGRAM-DP AND S DATA BUSES DK1,DK2,DK3 & DK4
VS70-720581	C	04/16/76	D01	07/02/76	SCHEMATIC DIAGRAM-DATA BUSES MM1 AND MM2
VS70-720582	B	03/29/78			SCHEMATIC DIAGRAM DATA BUS - MM1 AND MM2
VS70-720589	A	11/03/88			SCHEMATIC DIAGRAM DATA BUS-MM1 AND MM2
VS70-720591	C	04/16/76	D01	07/02/76	SCHEMATIC DIAGRAM-DATA BUS PLB01 & PLB02
VS70-720592	C	01/20/83			SCHEMATIC DIAGRAM-DATA BUS PLB01 & PLB02
VS70-720599	A	11/21/88			SCHEMATIC DIAGRAM - DATA BUS PLB01 & PLB02
VS70-720662	A	05/24/88			SCHEMATIC DIAGRAM-DP & S DATA BUSES FC 1,2,3,4,5,6,7 & 8

Table 4

D&C PANEL C3 MAIN ENGINE SHUTDOWN SWITCH MARKING ERROR

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DOCUMENT	REV	REV_DATE	LAST_EO	EO_DATE	TITLE
VS70-730156	NC	09/20/96			(VAX) BLOCK DIAGRAM-MEDS CONFIGURATION DISPLAY DRIVER UNIT
VS70-730151	NC	09/20/96			(VAX) SCHEMATIC DIAGRAM-CLOCK/DIVIDER/STATUS DIVIDER
VS70-730152	C	10/26/79			SCHEMATIC DIAGRAM-TIMERS SUBSYSTEM
VS70-730159	NC	05/01/80			SCHEMATIC DIAGRAM-TIMERS SUBSYSTEM
VS70-730162	E	11/15/94			SCHEMATIC DIAGRAM-D&C EXTERIOR LIGHTING SUBSYSTEM
VS70-730169	B	11/15/94			SCHEMATIC DIAGRAM-D & C EXTERIOR LIGHTING SUBSYSTEM
VS70-730172	D	08/01/91			SCHEMATIC DIAGRAM-DISPLAYS AND CONTROLS SUBSYSTEM
VS70-730182	D	01/20/98			SCHEMATIC DIAGRAM DISPLAYS & CONTROLS MEDS
VS70-730209	C	08/26/98			(CATIA)SCHEMATIC DIAGRAM AIRLOCK MODULE LIGHTING SUBSYSTEM
VS70-730219	B	04/06/99			(CATIA)SCHEMATIC DIAGRAM MANIPULATOR ARM LIGHTING SUBSYSTEM
VS70-730222	G	06/11/96			SCHEMATIC DIAGRAM-INSTRUMENT/NUMERIC LIGHTING SUBSYSTEM
VS70-730229	D	01/24/96			SCHEMATIC DIAGRAM - INSTR/NUMERIC LIGHTING SUBSYSTEM
VS70-730232	F	06/11/96			SCHEMATIC DIAGRAM-EDGE LIGHTED PANELS SUBSYSTEM
VS70-730239	D	06/03/96			SCHEMATIC DIAGRAM-EDGE LIGHTED PANELS SUBSYSTEM
VS70-730242	F	09/30/82			SCHEMATIC DIAGRAM-D&C ANNUNCIATOR SUBSYSTEM
VS70-730249	A	03/18/83			SCHEMATIC DIAGRAM-D&C ANNUNCIATOR SUBSYSTEM
VS70-730252	NC	10/15/75			SCHEMATIC DIAGRAM-DCKG MDL INTR/FLD LTG SUB STYSTEM
VS70-730262	B	05/10/95			SCHEMATIC DIAGRAM-HEAD DISPLAY SUBSYSTEM
VS70-730269	G	04/28/95			SCHEMATIC DIAGRAM-HEAD UP DISPLAY SUBSYSTEM
VS70-730622	A	09/01/83			SCHEMATIC DIAGRAM-CAUTION & WARNING SUBSYSTEM
VS70-731029	NC	11/10/83			SCHEMATIC DIAGRAM PSA POWER CONTROL PANEL PAYLOAD BAY
VS70-733111	B	03/03/76			SCHEMATIC DIAGRAM-DATA BUS SEL/LEFT DISPLAY PWR/ADI *
VS70-733211	B	03/03/76			SCHEMATIC DIAGRAM-DATA BUS SEL/RT DISPLAY PWR/ADI CONT*
VS70-733441	C	12/05/75	D01	05/25/77	SCHEMATIC DIAGRAM-FCS CHANNEL MONITOR/AIR DATA PROBE *
VS70-740100	B	09/14/79			BLOCK DIAGRAM-COMMUNICATIONS & TRACKING SUBSYSTEM
VS70-740102	K	09/16/88			SCHEMATIC DIAGRAM KU BAND COMMUNICATIONS SUB-SYSTEM
VS70-740108	F	09/15/88			SCHEMATIC DIAGRAM-KU BAND COMMUNICATIONS SUB-SYSTEM
VS70-740112	G	02/23/96			(VAX) SCHEMATIC DIAGRAM-C&T UHF EVA/ATC TRANSCEIVER
VS70-740119	E	01/28/99			(CATIA) SCHEMATIC DIAGRAM-COMM & TRACK UHF EVA/ATC TRANSCEIVER
VS70-740122	E	09/18/84			SCHEMATIC DIAGRAM-COMMUNICATIONS & TRACKING NETWORK S-BA*
VS70-740129	E	09/18/84			SCHEMATIC DIAGRAM-COMM & TRACKING NTWK S-BND TRANSPONDER
VS70-740132	E	09/20/84			SCHEMATIC DIAGRAM-C & T S-BAND POWER AMP SUBSYSTEM
VS70-740139	E	02/15/88			SCHEMATIC DIAGRAM-COMM & TRACK POWER AMP SUBSYSTEM
VS70-740152	B	03/02/82			SCHEMATIC DIAGRAM-C & T RARAD ALTIMETER
VS70-740158	D	07/28/88			SCHEMATIC DIAGRAM-COMM AND TRACK RADAR ALTIMETER
VS70-740172	G	01/31/85			SCHEMATIC DIAGRAM-COMMUNICATION & TRACKING TACAN SUB-SYS
VS70-740179	H	08/13/93			SCHEMATIC DIAGRAM-COMMUNICATION & TRACKING TACAN SUBSYSTEM
VS70-740182	J	10/31/84			SCHEMATIC DIAGRAM-TV COMM AND TRACKING SUBSYSTEM
VS70-740189	L	04/06/99			SCHEMATIC DIAGRAM-TV COMM AND TRACKING SUBSYSTEM
VS70-740199	E	12/07/88			SCHEMATIC DIAGRAM-TEXT & GRAPHICS SUBSYSTEM
VS70-740200	B	05/01/79			CHEMATIC BLOCK DIAGRAM-COMM AND TRCKING SUBSYSTEM
VS70-740222	D	08/20/81			SCHEMATIC DIAGRAM-C AND T-S-BAND NETWORK SIGNAL PROCESSOR
VS70-740229	G	07/11/97			SCHEMATIC DIAGRAM-C&T S-BAND NETWORK SIGNAL PROCESSOR
VS70-740232	E	09/18/84			SCHEMATIC DIAGRAM-C&T PAYLOAD INTERROGATOR & SIG PROCESS*
VS70-740239	D	05/10/88			SCHEMATIC DIAGRAM-C&T PAYLOAD INTERRO & SIG PROCESSOR *
VS70-740242	K	02/29/96			SCHEMATIC DIAGRAM-AUDIO COMM & TRACKING SUBSYSTEM
VS70-740249	G	02/13/96			(VAX) SCHEMATIC DIAGRAM-AUDIO COMM & TRACKING SUBSYSTEM
VS70-740252	G	11/14/84			SCHEMATIC DIAGRAM-S-BAND ANTENNA SWITCH ASSY
VS70-740259	H	05/06/85			SCHEMATIC DIAGRAM-S-BAND ANTENNA SWITCH SUBSYSTEM
VS70-740262	D	11/14/84			SCHEMATIC DIAGRAM-COMM & TRACKING,S-BAND FM SIGNAL PROC
VS70-740269	B	11/13/84			SCHEMATIC DIAGRAM COMM & TRACKING,S-BAND FM SIGNAL PROCE*
VS70-740272	D	11/13/84			SCHEMATIC DIAGRAM-COMMUNICATION & TRACKING, S-BAND FM TR*
VS70-740279	D	11/13/84			SCHEMATIC DIAGRAM-COMM & TRACKING,S-BAND FM TRANSMITTER
VS70-740281	B	05/02/75	C01	08/01/77	SCHEMATIC DIAGRAM-COMM & TRACKING,S-BAND FM TRANSMITTER
VS70-740282	C	01/27/83			SCHEMATIC DIAGRAM-COMMUNICATION & TRACKING, S-BAND DEI *
VS70-740289	C	04/01/88			SCHEMATIC DIAGRAM - COMMUNICATIONS AND TRACKING GLOBAL *
VS70-740292	F	11/15/84			SCHEMATIC DIAGRAM-C & T GROUND COMMAND INTERFACE LOGIC *
VS70-740299	F	04/28/88			SCHEMATIC DIAGRAM-C & T GND CMD INTERFACE LOGIC CONT
VS70-740300	D	08/23/95			(VAX)BLOCK DIAGRAM COMMUNICATIONS & TRACKING SUBSYSTEMS
VS70-740301	B	07/02/76			SCHEMATIC DIAGRAM-COMMUNICATION & TRACKING C-BAND BEACON
VS70-740302	A	11/16/84			SCHEMATIC DIAGRAM-C&T S-BAND NETWORK SIGNAL PROCESSOR
VS70-740341	D	07/02/76			SCHEMATIC DIAGRAM-AUDIO,COMM AND TRACKING SUBSYSTEM
VS70-740351	D	07/02/76			SCHEMATIC DIAGRAM - C AND T RADAR ALTIMETER
VS70-740371	C	10/27/76	D01	08/01/77	SCHEMATIC DIAGRAM-COMM AND TRACKING TACAN SUBSYSTEM
VS70-740400	D	08/23/95			(VAX) POWER BLOCK DIAGRAM COMMUNICATION AND TRACKING *
VS70-740501	A	03/16/76			BLOCK DIAGRAM-COMM & TRACKING SUBSYSTEM
VS70-740511	C	02/25/76			SCHEMATIC DIAGRAM-COMM AND TRACKING UHF TRANSCEIVER
VS70-740561	C	08/21/75	D01	02/07/76	SCHEMATIC DIAGRAM-COMM & TRACKING,MICROWAVE SCAN BEAM *
VS70-740562	C	01/03/85			SCHEMATIC DIAGRAM-COMM & TRACKING,MICROWAVE SCAN BEAM *
VS70-740569	C	06/22/88			SCHEMATIC DIAGRAM-COMM&TRACKING,MICROWAVE SCAN BEAM *
VS70-740572	NC	12/23/82			SCHEMATIC DIAGRAM-S-BAND ANTENNA SWITCH SUBSYSTEM
VS70-740601	B	11/30/76			BLOCK DIAGRAM-POWER COMMUNICATION & TRACKING SUBSYSTEM

Table 4

D&C PANEL C3 MAIN ENGINE SHUTDOWN SWITCH MARKING ERROR

Presenter:

Organization/Date:
Orbiter/11-19-99

DOCUMENT	REV	REV_DATE	LAST_EO	EO_DATE	TITLE
VS70-750162	R	09/29/94			SCHEMATIC DIAGRAM-PAYLOAD DATA INTERLEAVER
VS70-750169	L	09/29/94			SCHEMATIC DIAGRAM-PAYLOAD DATA INTERLEAVER
VS70-750201	B	07/02/76	B01	07/02/76	SCHEMATIC DIAGRAM-OI POWER AND CONTROL
VS70-750202	P	09/29/94			SCHEMATIC DIAGRAM-OI POWER & CONTROL
VS70-750209	N	09/29/94			SCHEMATIC DIAGRAM-OI POWER & CONTROL
VS70-750232	A	05/17/83			(CAD)SCHEMATIC DIAGRAM MASTER TIMING UNIT
VS70-750242	NC	02/18/83			(CAD)SCHEMATIC DIAGRAM-FLT ACCELN MONITOR SYS SUBSYSTEM
VS70-750243	NC	02/18/83			(CAD)SCHEMATIC DIAGRAM-FLT ACCELN MONITOR SYS SUBSYSTEM
VS70-750249	B	04/26/83			SCHEMATIC DIAGRAM-FLT ACCELERATION MONITOR SYS SUBSYSTEM
VS70-750332	F	01/22/92			SCHEMATIC DIAGRAM-MASTER TIMING UNIT
VS70-750342	A	06/05/91			SCHEMATIC DIAGRAM MID FUSELAGE MEAS(V34)-OI SUB SYSTEM
VS70-750582	C	12/02/82			SCHEMATIC DIAGRAM-OI-HYDRAULIC MEASUREMENTS
VS70-750589	K	07/28/96			SCHEMATIC DIAGRAM-OI-HYDRAULIC MEASUREMENTS
VS70-750682	F	07/28/96			SCHEMATIC DIAGRAM-OI-HUYDRAULIC MEASUREMENTS
VS70-750782	NC	03/05/83			SCHEMATIC DIAGRAM-OI-HYDRAULIC MEASUREMENTS
VS70-760009	NC	07/02/79			DRAWING TREE-AVIONICS SUBSYS SCHEMATICS ORBITER 099
VS70-760098	B	07/21/76			SCHEMATIC DIAGRAM-INSTRUMENTATION PWR & CONTROLS MPTA
VS70-760191	NC	11/24/76			SCHEMATIC DIAGRAM-ST FIRING CONT ASSY FWD RCS WSTF
VS70-760202	G	01/14/83			SCHEMATIC DISGRAM-COAS,SEAT/SUIT CONTROLS CREW SYSTEMS
VS70-760209	D	11/13/84			SCHEMATIC DIAGRAM-COAS SEAT/SUIT CONTROLS CREW SYSTEMS
VS70-760252	C	06/20/84			SCHEMATIC DIAGRAM-COAS SEAT/SUIT CONTROLS CREW SYSTEMS
VS70-760262	A	06/22/84			SCHEMATIC DIAGRAM-COAS,SEAT/SUIT CONTROLS CREW SYSTEMS
VS70-760272	NC	02/09/83			(CAD)SCHEMATIC DIAGRAM 510-MEDICAL CABLES
VS70-760291	A	10/25/77			SCHEMATIC DIAGRAM-STATIC FIRING CONT ASSY,AFT RCS WSTF
VS70-760301	C	01/25/75	D01	07/02/76	SCHEMATIC DIAGRAM-MAIN DC PWR DISTRIBUTION SUBSYSTEM
VS70-760302	G	01/27/83			SCHEMATIC DIAGRAM-MAIN DC POWER DISTRIBUTION SUBSYSTEM
VS70-760309	P	02/15/95			SCHEMATIC DIAGRAM-MAIN DC POWER DISTRIBUTION SUBSYSTEM
VS70-760311	A	08/12/75			SCHEMATIC DIAGRAM-MAIN DC EPDC BREADBOARD
VS70-760312	A	09/08/76			SCHEMATIC DIAGRAM-MAIN DC EPDC BREADBOARD (ORBITER 102)
VS70-760322	H	07/07/99			SCHEMATIC DIAGRAM-MAIN DC POWER DISTRIBUTION SUBSYSTEM
VS70-760332	NC	03/30/83			SCHEMATIC DIAGRAM-MAIN DC PWR DISTRIBUTION SUBSYSTEM
VS70-760351	NC	07/08/77			SCHEMATIC DIAGRAM-STATIC FIRING CONTROL ASSM OMS POD*
VS70-760401	C	12/04/75	D03	07/29/77	SCHEMATIC DIAGRAM-AC PWR DISTR AND CONT SUBSYSTEM
VS70-760402	P	02/25/92			SCHEMATIC DIAGRAM-AC PWR DIST & CONTROL-SUBSYSTEM
VS70-760409	E	12/15/89			SCHEMATIC DIAGRAM-AC PWR DIST & CONTROL-SUBSYSTEM
VS70-760462	K	06/09/99			(CATIA)SCHEMATIC DIAGRAM OEX INTERFACE BLOCK DIAGRAM
VS70-760472	C	02/06/87			(CAD)SCHEMATIC DIAGRAM-OEX/MADS INTERFACE BLOCK DIAGRAM
VS70-760501	F	10/19/77	E01	07/02/76	SCHEMATIC DIAGRAM-EVCON SUBSYSTEM
VS70-760502	R	10/26/85	H01	10/25/91	SCHEMATIC DIAGRAM-EVCON SUBSYSTEM
VS70-760503	G	10/31/95			SCHEMATIC DIAGRAM-EVCON SUBSYSTEM
VS70-760509	C	03/24/83			SCHEMATIC DIAGRAM-EVCON SUBSYSTEM
VS70-760512	F	12/15/89			SCHEMATIC DIAGRAM-CAMERA SUBSYSTEM,UMBILICAL WELL
VS70-760513	B	07/27/92			(VAX) SCHEMATIC DIAGRAM - UMBILICAL WELL CAMERA SUBSYSTEM
VS70-760515	NC	02/13/89			(VAX)SCHEMATIC DIAGRAM-SRB & ET SEPN 35MM STILL CAMERA SUBSYSTEM
VS70-760522	A	11/13/81			SCHEMATIC DIAGRAM - IECM/REM DEPLOYMENT SUBSYSTEM
VS70-760532	B	03/15/82			SCHEMATIC DIAGRAM-OSS-1 PDP/REM DEPLOYMENT SUBSYSTEM
VS70-760552	C	08/12/82			SCHEMATIC DIAGRAM-DATA ACQ CONTROL CAMERAS PAYLOAD BAY
VS70-760701	B	05/26/76			SCHEMATIC DIAGRAM-ORBITER CAMERAS SUBSYSTEM
VS70-760702	H	08/29/86			SCHEMATIC DIAGRAM-MOTOR CONTROL ASSY POWER DISTRIBUTION
VS70-760709	E	11/15/90			SCHEMATIC DIAGRAM-MOTOR CONTROL ASSY POWER DISTRIBUTION
VS70-760802	K	04/28/82			SCHEMATIC DIAGRAM-PAYLOAD SUBSYSTEM INTERFACE
VS70-760809	AB	#N/A			SCHEMATIC DIAGRAM-PAYLOAD SUBSYSTEM INTERFACE
VS70-760902	E	02/16/99			SCHEMATIC DIAGRAM-EXTRAVEHICULAR MOBILITY UNIT,PWR SUPPLY
VS70-760909	F	01/28/99			(CATIA)SCHEMATIC DIAGRAM EXTRAVEHICULAR MOBILITY UNIT POWER *
VS70-760991	NC	12/05/74			SCHEMATIC DIAGRAM-ORBITER GROUND SUBSYSTEM EPDC
VS70-760198	NC	09/28/76			MPTA TAB SCHEM DIAG AERO/THERM DYN-STRUCT DYN-TPS/TCS
VS70-780301	C	05/11/76	D01	07/02/76	SCHEMATIC DIAGRAM-DFI-FDM W/B RECORDER
VS70-780335	A	11/07/90			(VAX) SCHEMATIC DIAGRAM - V31/V32/V33 MEAS-GSE MODAL INSPECT*
VS70-780398	B	05/27/77			SCHEMATIC DIAGRAM DSC/MDM INTERFACE DFI MPTA
VS70-780598	B	02/02/77			SCHEMATIC DIAGRAM-MPTA HYDRAULIC INSTRUMENTATION
VS70-780601	B	03/19/75	C01	07/02/76	SCHEMATIC DIAGRAM-DFI DATA BUS/PCM DIGITAL INTERFACE
VS70-780609	B	02/16/84			SCHEMATIC DIAGRAM-FLT ACCELERATION MONITORING SYS(FAMOS)*
VS70-781201	NC	04/23/84			(CAD) SCHEMATIC DIAGRAM-IN-FLIGHT REFUELING POWER & SIGN*
VS70-790098	B	01/18/77			SCHEMATIC DIAGRAM FLIGHT CONTROL SUBSYSTEM MPTA
VS70-790112	C	01/24/80			SCHEMATIC DIAGRAM-ACCELEROMETER ASSY FLT CONTROL SUBSYSTM
VS70-790119	NC	11/12/80			SCHEMATIC DIAGRAM-ACCLRM ASSY FLT CONTROL SUBSYSTEM
VS70-790122	C	11/03/80			SCHEMATIC DIAGRAM-ROTATION HAND CONT FLT CONT SUBSYSTEM
VS70-790129	B	07/31/84			SCHEMATIC DIAGRAM-ROTATION HAND CONTROL FLT CONTROL SUB*
VS70-790132	C	11/26/80			SCHEMATIC DIAGRAM-SPEED BRAKE THRUST CONTROL FLT CONTRO *
VS70-790139	NC	11/26/80			SCHEMATIC DIAGRAM-SPEED BRAKE THRUST CONTROL FLT CONTROL*
VS70-790142	B	06/26/78			SCHEMATIC DIAGRAM-RUDDER PEDAL XDCR ASSY FLT CONT SUBSYS
VS70-790149	NC	01/29/81			SCHEMATIC DIAGRAM - RUDDER PEDAL XDCR ASSY FLT CONTROL*

Table 4

	Presenter:
	Organization/Date: Orbiter/11-19-99

RSC MANIFOLD 5 OXIDIZER ISOLATION VALVE BACKUP

RSC MANIFOLD 5 OXIDIZER ISOLATION VALVE

Presenter:

Organization/Date:
Orbiter/11-19-99

Manifold 5 Solenoid Valve Usage History

MANIFOLD 5 SOLENOID VALVE USAGE HISTORY

POD or MODULE	VALVE	PART NUMBER MC284-0420	SERIAL NUMBER	1st FLIGHT	# of FLIGHTS	REPLACEMENT PART NUMBER MC284-0420	REPLACEMENT SERIAL NUMBER	1st FLIGHT	# of FLIGHTS
FRC2	LV157	-0012	014	STS-1 4/12/81	26				
	LV158	-0011	013	STS-1 4/12/81	26	*-0011*	*027*	STS-107 TBD	20
FRC3	LV157	-0012	033	STS-14 8/30/84	26				
	LV158	-0011	035	STS-14 8/30/84	26				
FRC4	LV157	-0012	008	STS-28 10/3/85	20				
	LV158	-0011	026	STS-28 10/3/85	20				
FRC5	LV157	-0012	038	STS-49 5/7/92	13				
	LV158	-0011	036	STS-49 5/7/92	13				
LP01	LV257	-0012	022	STS-6 4/4/83	28				
	LV258	-0011	020	STS-6 4/4/83	28				
LP03	LV257	-0012	030	STS-13 4/6/84	24				
	LV258	-0011	024	STS-13 4/6/84	24				
LP04	LV257	-0012	034	STS-25 6/17/85	20				
	LV258	-0011	007	STS-25 6/17/85	20				
LP05	LV257	-0012	040	STS-50 6/25/92	15				
	LV258	-0011	037	STS-50 6/25/92	15				
RP01	LV357	-0012	032	STS-6 4/4/83	27				
	LV358	-0011	009	STS-6 4/4/83	25	-0011	028	STS-88 1/22/98	2
RP03	LV357	-0012	031	STS-14 8/30/84	27				
	LV358	-0011	025	STS-14 8/30/84	27	*-0011*	*013*	STS-103 TBD	26
RP04	LV357	-0012	029	STS-24 4/29/85	20				
	LV358	-0011	027	STS-24 4/29/85	20	-0011	008	STS-101 TBD	25
RP05	LV357	-0012	039	STS-50 6/25/92	14				
	LV358	-0011	023	STS-50 6/25/92	14				

	Presenter:
	Organization/Date: Orbiter/11-19-99

HYDRAULIC MAIN PUMP TORSION SPRING BACKUP

HYDRAULIC MAIN PUMP TORSION SPRING

Presenter:

Organization/Date:
Orbiter/11-19-99

Observation:

- One of the two main hydraulic pump torsion springs was out of the hanger
  - Wear noted along the side of the hanger and the housing
  - Found during failure investigation of pump, MC281-0029-0008 S/N 192323, for unrelated ATP failure. (leakage at front housing/mounting flange split line)

Concern:

- Pumps in the field may have the same problem
  - Improperly assembled pump with the torsion spring out of the hanger, could cause erratic discharge pressure and loss of associated APU/HYD system (1R2)

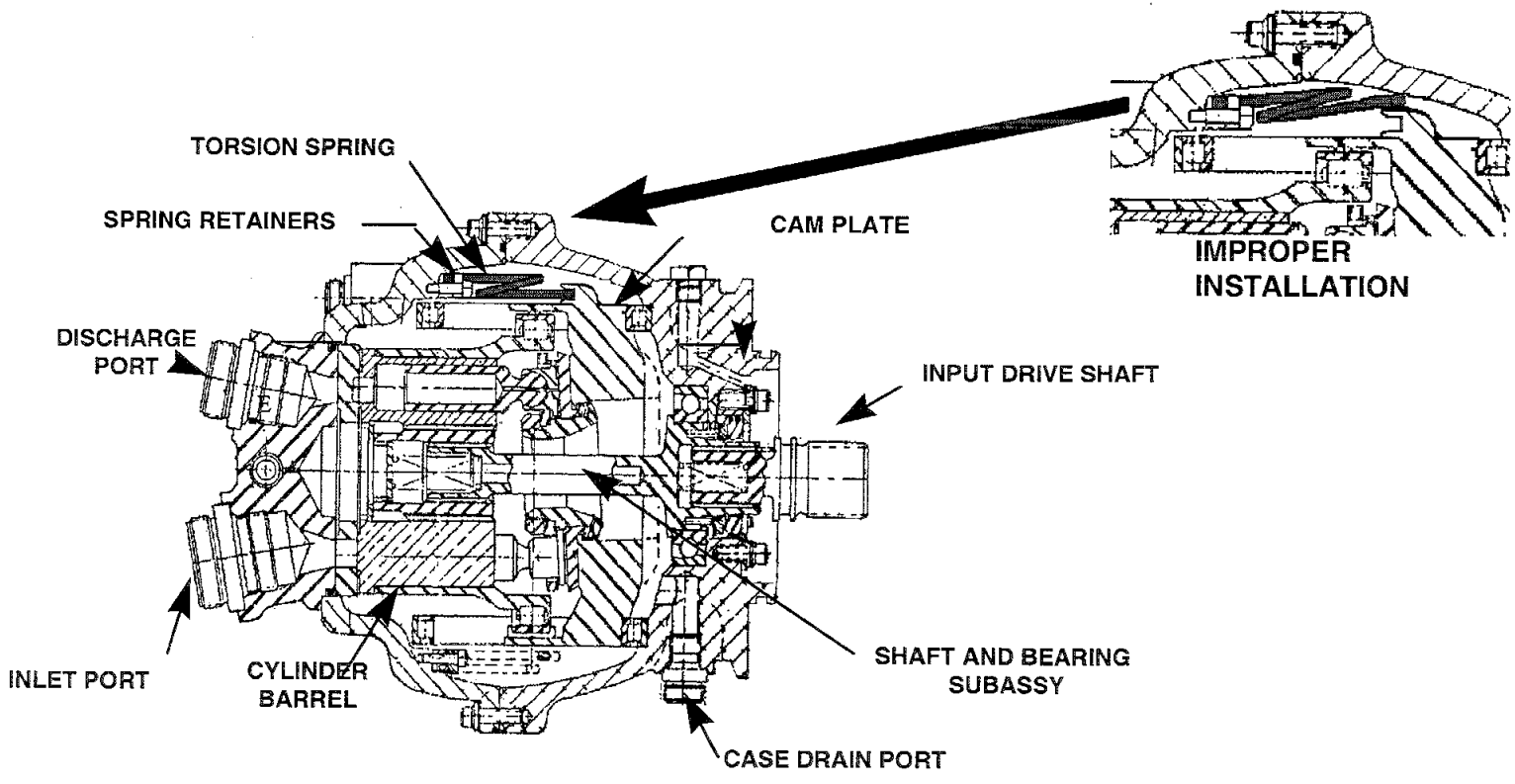
Acceptable For STS-103 Flight:

- Correct pump torsion spring installations have been verified by x-rays
- Springs properly installed in their respective hangers, will remain in the hanger
- Hydraulic system is acceptable for flight

HYDRAULIC MAIN PUMP TORSION SPRING

Presenter:

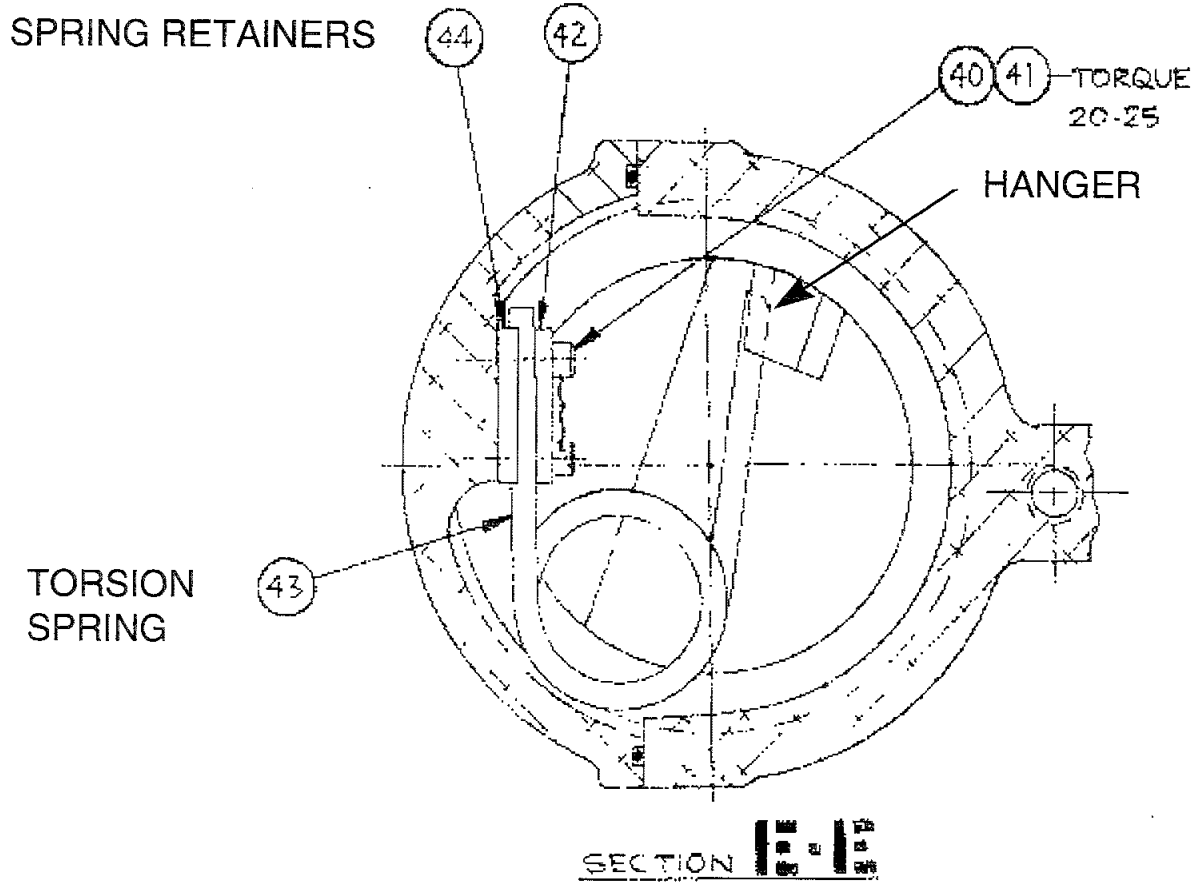
Organization/Date:
Orbiter/11-19-99



NOTE: COMPENSATOR, EDV (ELECTRO DEPRESSURIZATION VALVE) AND STROKING PISTON NOT SHOWN

HYDRAULIC MAIN PUMP TORSION SPRING

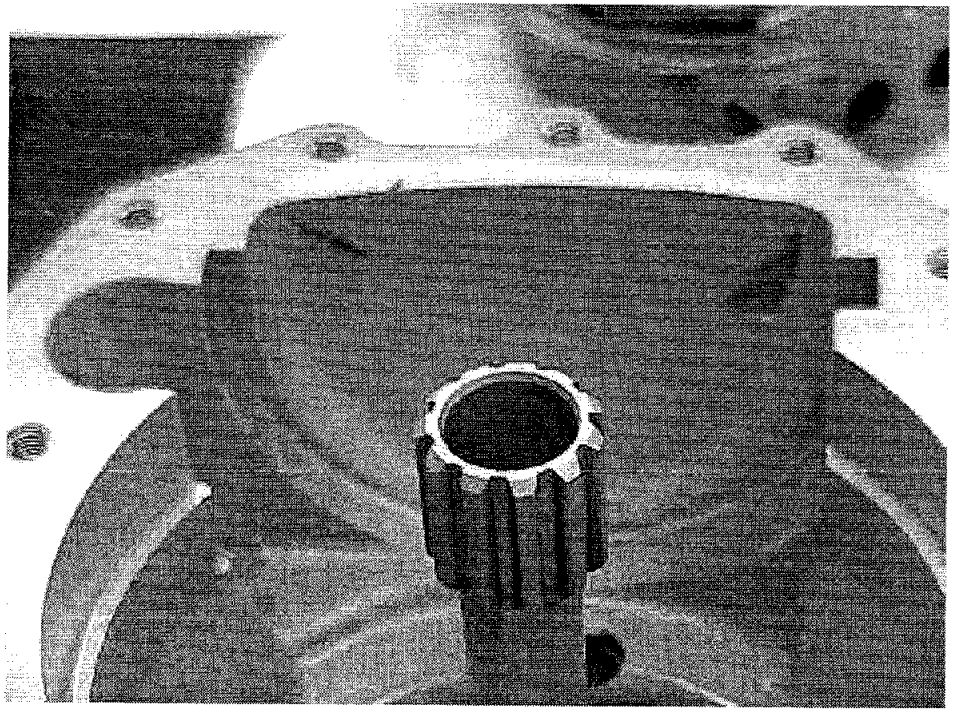
Presenter:
Organization/Date: Orbiter/11-19-99



Torsion Spring Seated in Hanger

HYDRAULIC MAIN PUMP TORSION SPRING

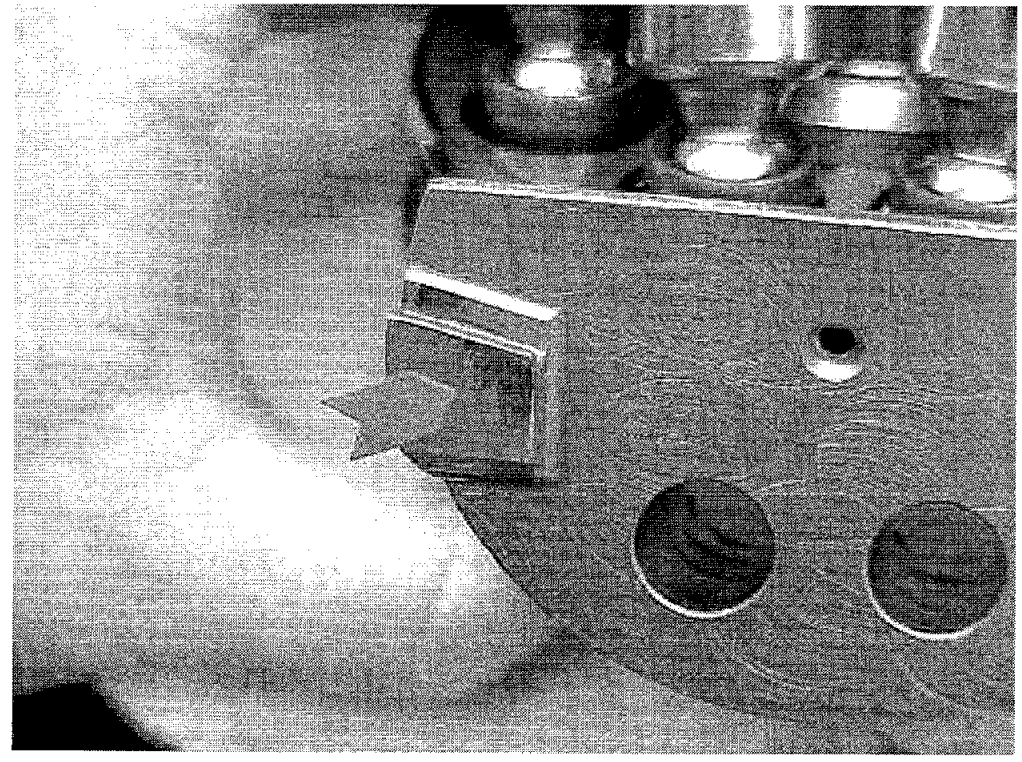
Presenter:
Organization/Date: Orbiter/11-19-99



Damage on Mounting Flange Housing

HYDRAULIC MAIN PUMP TORSION SPRING

Presenter:
Organization/Date: Orbiter/11-19-99



Hanger Subassembly

HYDRAULIC MAIN PUMP TORSION SPRING

Presenter:

Organization/Date:
Orbiter/11-19-99

Discussion:

- Reviewed flight data and ATP data
  - No indication of erratic or degraded performance
- Reviewed failure history
  - SRB pump inspections found pump with both springs not in hanger cradles (pump passed all ATP requirements)
  - No previous report of this problem in Orbiter PRACA data base
- Reviewed design
  - Methods verified that could result in improper installations
  - Design precludes properly installed spring coming out of hanger during operation (requires g-loads of 2500 + g's)
  - ABEX determined pump can not be assembled if springs are swapped during assembly

HYDRAULIC MAIN PUMP TORSION SPRING	Presenter:
	Organization/Date: Orbiter/11-19-99

Discussion: (Cont)

- Reviewed history of failed unit
  - Pump was disassembled in 1996
    - Most likely cause of the failure is improper assembly
- Verified capability of x-ray to detect spring in hanger
  - Obtained sample x-ray from supplier
  - X-rayed pump (engineering test unit) at Downey as a proof of concept for x-raying the OV-103 pumps
- OV-103 x-ray's complete
  - All springs verified installed in their hangers
  - All other vehicles x-ray's at KSC complete
    - All springs installed in proper position

HYDRAULIC MAIN PUMP TORSION SPRING

Presenter:

Organization/Date:
Orbiter/11-19-99

Risk Assessment:

- Worst case failure could result in pump cam plate jam
  - Jammed cam plate results in loss of pump function (Crit 1R2)
  - However, pump design appears to be able to preclude jamming

Acceptable For STS-103 Flight:

- Correct pump torsion spring installations have been verified by x-rays
- Springs properly installed in their respective hangers, will remain in the hanger
- Hydraulic system is acceptable for flight

HYDRAULIC MAIN PUMP TORSION SPRING

Presenter:

Organization/Date:
Orbiter/11-19-99

Follow-On Actions:

- Certification deviation being processed to allow usage of both numeric and pictorial spring retainer configurations called out on Abex assembly drawings
  - Deviation will be in force pending approval of Engineering Design Change Proposal (EDCP) for both spring retainer configurations

HYDRAULIC MAIN PUMP TORSION SPRING

Presenter:

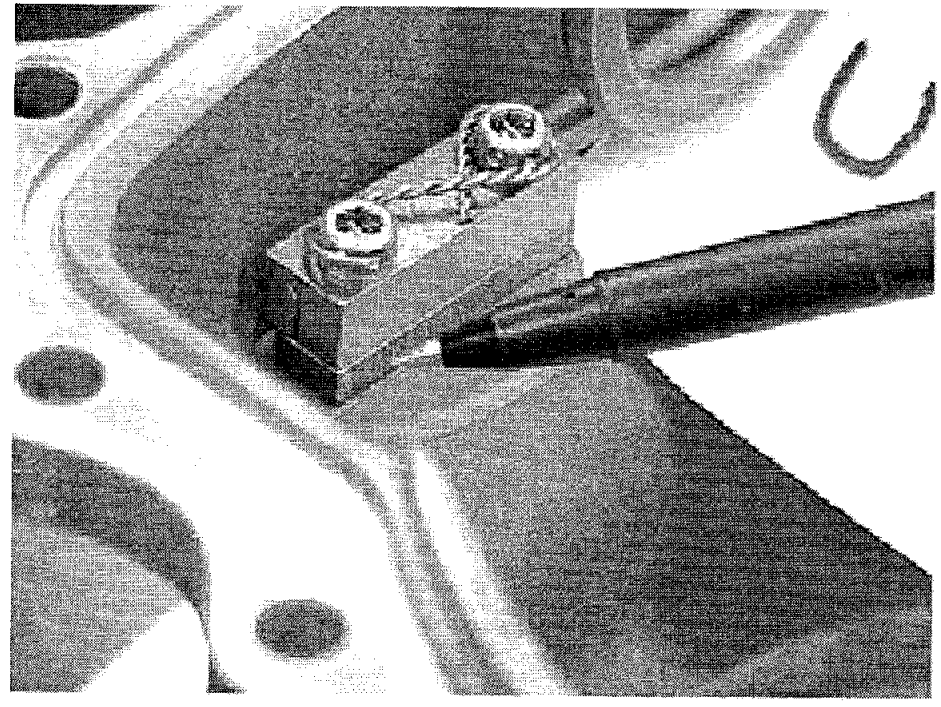
Organization/Date:
Orbiter/11-19-99

Pedigree of Failed Pump (S/N 192323) Has Been Reviewed

- Built in 1982 MC281-0029-0006
- Installed on OV-103 system 2 since first flight of OV-103 (21 flights)
  - Removed during OMM (1995).
  - Sent to the supplier for mod to –0007 (depress piston cap), then to –0008 (depress solenoid wire harness)
- At the supplier, the front housing exhibited scratches and removal of the hard coat anodize in the stroking piston bore.
  - The housing was repaired
  - The pump was reassembled and passed ATP (1996)
    - Modified with sleeved depress piston cap
    - Modified with improved solenoid wire harness
- Installed on OV-105 system 3 at KSC after OMM (1998)
  - Flew one flight: STS-89 removed postflight due to leakage at pump outlet/flexhose interface **(ref. KB3980-010)**
- 1999 KB3980-010 Outlet leakage failure analysis: Tested at vendor for over an hour at high temperature (240 F) and full flow. No external leakage at outlet fitting. Additional testing varying flow from 0 to full flow detected small amount of leakage (approx. 2 drops/minute). Outlet fitting was removed and sent to Downey for F/A. No radial scratches found. UA
  - **Outlet fitting replaced. Performed ATP. Leakage at mid-flange (front housing / mounting flange housing). Opened up the pump and found housing and hanger damage indicating one of the torsion springs was outside the hanger (ref. AE1848-010)**

HYDRAULIC MAIN PUMP TORSION SPRING

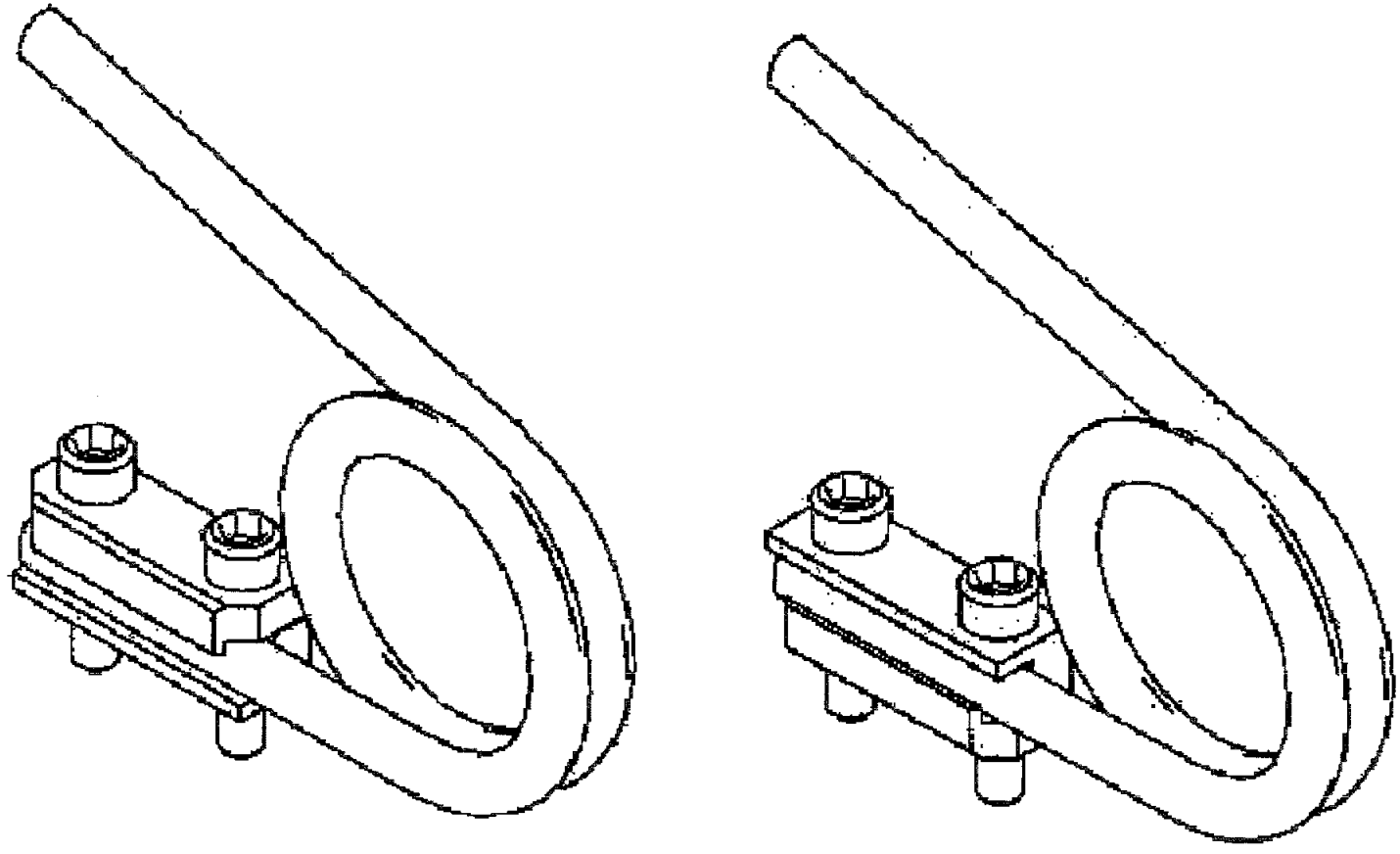
Presenter:
Organization/Date: Orbiter/11-19-99



Proper Spring Retainer Installation

HYDRAULIC MAIN PUMP TORSION SPRING

Presenter:
Organization/Date: Orbiter/11-19-99

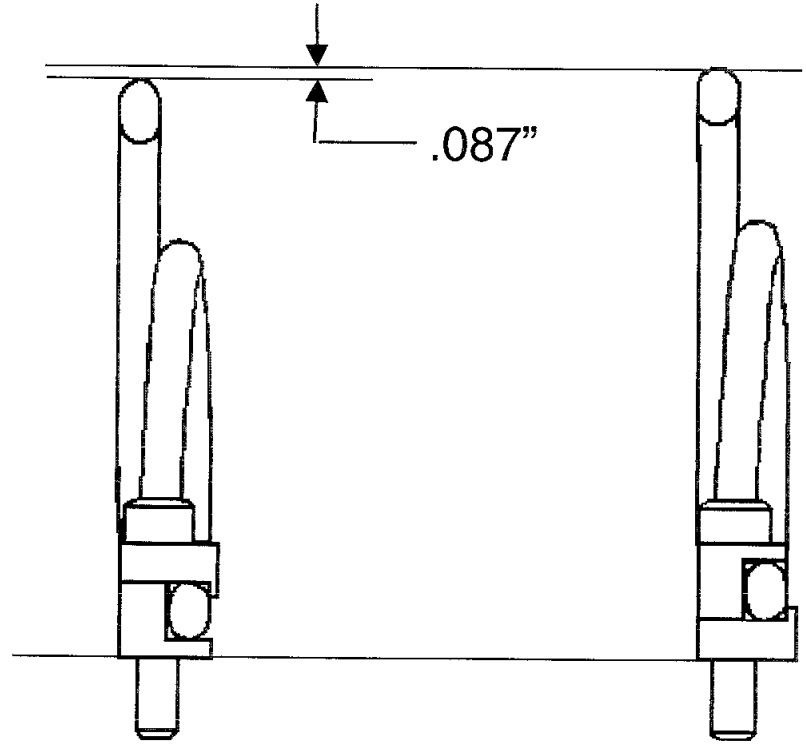


HYDRAULIC MAIN PUMP TORSION SPRING

Presenter:

Organization/Date:
Orbiter/11-19-99

- ABEX indicated that both installation techniques result in identical pump performance

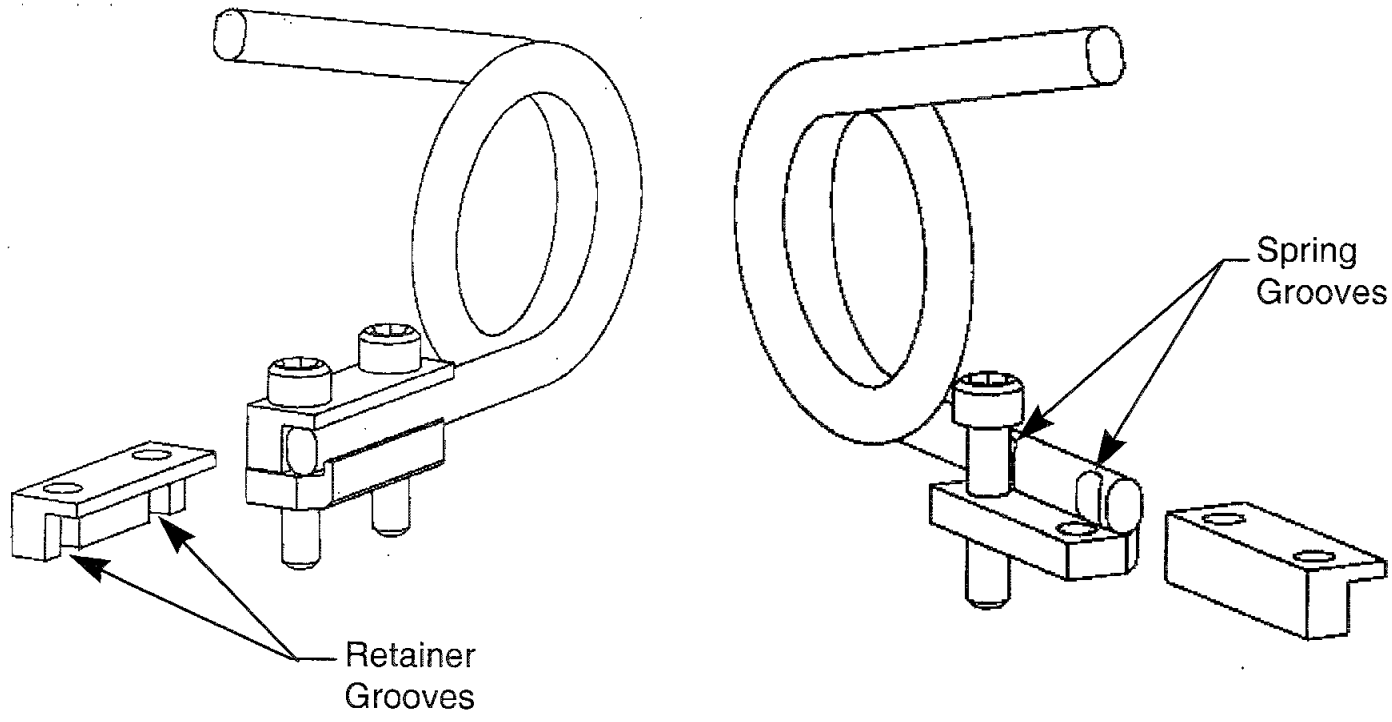


Retainer installation of the subject pump

Retainers installed properly

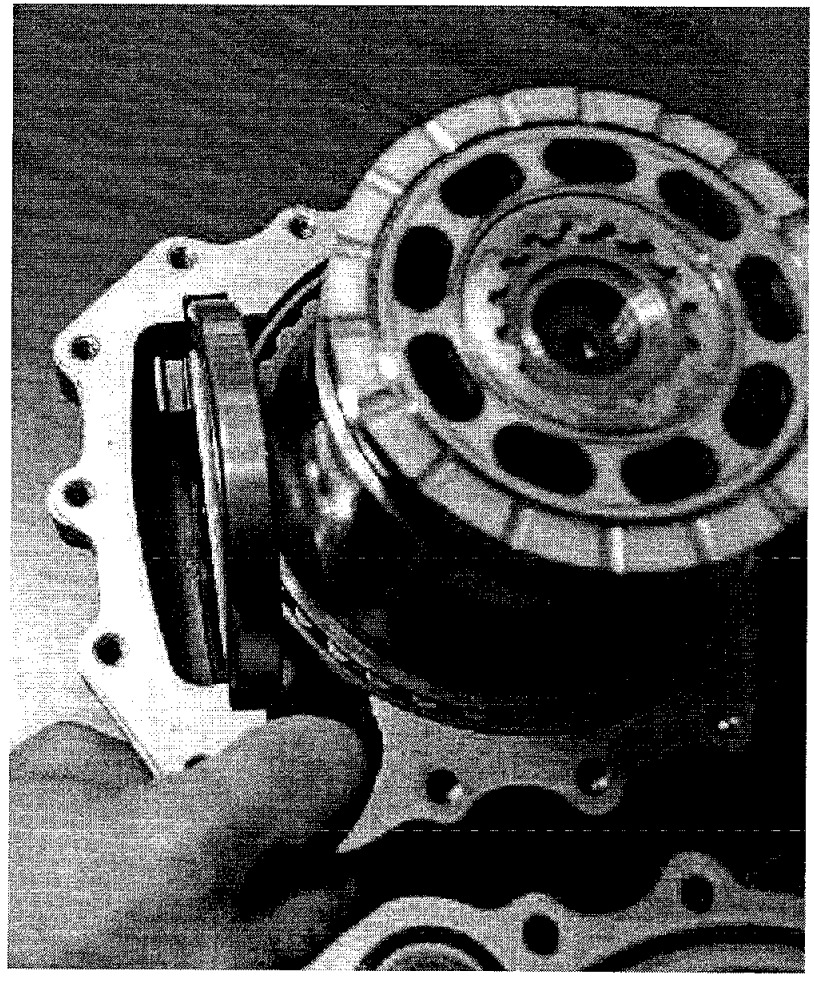
HYDRAULIC MAIN PUMP TORSION SPRING

Presenter:
Organization/Date: Orbiter/11-19-99



HYDRAULIC MAIN PUMP TORSION SPRING

Presenter:
Organization/Date: Orbiter/11-19-99



HYDRAULIC MAIN PUMP TORSION SPRING

Presenter:
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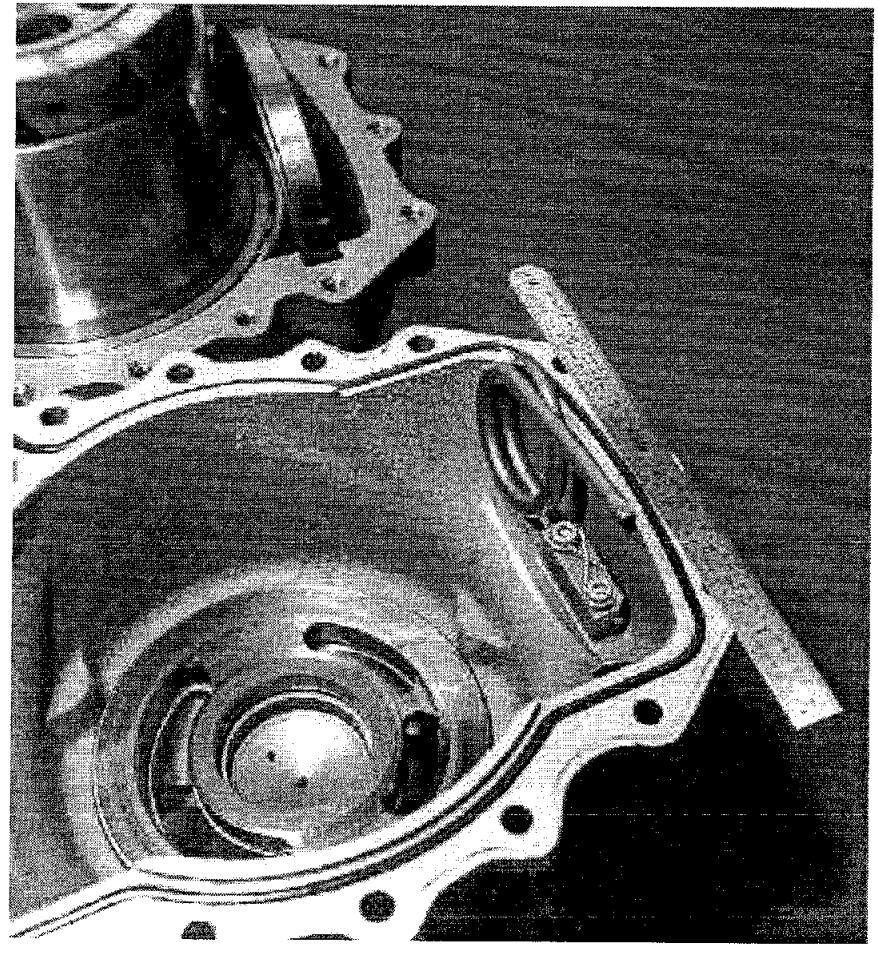

	Presenter:
	Organization/Date: Orbiter/11-19-99

EXTERNAL TANK GO2 2 INCH DISCONNECT FAILURE ON ET-106 BACKUP

EXTERNAL TANK GO2 2 INCH DISCONNECT FAILURE ON ET-106

Presenter:

Organization/Date:
Orbiter/11-19-99

DATE	SIGNIFICANT MR/DR	EVENT
2/19/97		POPPETS FROM LOT 6-7059 MACHINED AT EVAD. QUANTITY OF 4.
3/28/97		AFTER HONE & LAP, PAPER SPECIFIES SPECIAL HANDLING ON 2 POPPETS. REQUIRED CHROME BUILDUP ON UNDERSIZE END. REQUEST MAX PLATING THICKNESS OF 0.0005"
4/3/97		CHROME PLATING PERFORMED BY DIXON HARDCHROME.
4/14/97	DR 68330	1 OF 4 POPPETS FLAGGED FOR OUT OF ROUNDNESS (0.3089 - 0.30895).
4/14/97		6-7059 LOT SPLIT INTO 2 LOTS: 6-7059 - DR 68330 POPPET, S/N 7413-6. 6-7059A - REMAINING 3 POPPETS, S/N 7413-1,2, & 3
4/21/97		DR 68330 POPPET (7413-6) DISPOSITIONED FOR USE "AS IS"
4/28/97	DR 68388	ALL 4 POPPETS ARE FLAGGED FOR CHROME PLATING ISSUES. 2 HAVE TOOL MARKS/SCRATCHES. 2 ARE NOT POLISHED 100%. CANNOT REPOLISH BECAUSE ACTUAL DIAMETER IS TOO LOW (0.3087). DISPO TO RETURN TO B/P BY GRINDING AWAY EXISTING PLATING AND REPLATE. SENT TO CPPG
5/20/97	DR 68395	CONCENTRICITY DISCREPANCY (0.004", S/B NMT 0.001") ON POPPET S/N 7413-6.
5/21/97		LOT 6-7059A POPPETS (3) SENT TO STOCKROOM.
6/12/97		POPPET 7413-6 REWORKED (DR68395) AND RETURNED TO PRINT. CORRECTIVE ACTION IMPLEMENTED TO SEND ALL FUTURE MACHINING TO OUTSIDE SOURCE.
6/18/97		POPPET 7413-6 SENT TO STOCKROOM.
7/30/97		DISCONNECT 1222 WITH POPPET 7413-6 INSTALLED COMPLETES BUILD PROCESS AND PASSES ATP.
Aug-97		DISCONNECT 1222 INSTALLED INTO LO2 EI 101 AT PALMDALE.
10/20/97		DISCONNECT 1222 ET SIDE FLANGE LAPPED
10/27/97	DS1311	DURING RECHECK OF HEIGHT MEASUREMENTS AFTER 17" DISCONNECT INTERFACE SURFACE LAPPING, 1222 POPPET STEM IS OFF CENTER BY 0.0035". DISCONNECT WAS RECENTERED.
Mar-98		DISCONNECT 1222 REMOVED FROM UMBILICAL DUE TO 17" DISCONNECT TORSION BAR PROBLEM.
Feb-99		DISCONNECT 1222 REINSTALLED INTO LO2 UMBILICAL EI 101.
May-99		LO2 UMBILICAL EI 101 DELIVERED TO MAF
11/1/99		FIRST PRESSURIZATION CYCLE OF LO2 TANK ON ET106. BLOWING LEAK DISCOVERED AS FLEXHOSE REMOVED FROM GSE TOOL INSTALLED ON GO2 2" DISCONNECT (1222). POPPET FOUND STUCK OPEN.
1986	NONE	**STS-103 ET GH2 2" DISCONNECT (S/N 1198)** MANUFACTURED. POPPET CHROME PLATING PERFORMED BY **MODERN PLATING CO.** NO DR/MR HISTORY DURING BUILD OR PALMDALE UMBILICAL ASSEMBLY. UMBILICAL WAS NOT REWORKED FOR 17" DISCONNECT TORSION BAR ISSUE.
1991	NONE	**STS-103 ET GO2 2" DISCONNECT (S/N 1216)** MANUFACTURED. POPPET CHROME PLATING PERFORMED BY **U.S. CHROME.** NO DR/MR HISTORY DURING BUILD OR PALMDALE UMBILICAL ASSEMBLY. UMBILICAL WAS NOT REWORKED FOR 17" DISCONNECT TORSION BAR ISSUE.

EXTERNAL TANK GO2 2 INCH DISCONNECT FAILURE ON ET-106

Presenter:

Organization/Date:
Orbiter/11-19-99

OMRSD	WAD the OMRS is Implemented in	Requirement title/Description	Pass/Fail Criteria
Orbiter Inspections prior to rollout (OPF)			
V41 BVO.030-D (GO2) V41 BVO.030-E (GH2)	*Job Card 20013 / 20012*	**PD4/PD5 PRESS DISC INSPECTION** VERIFY VALVE IS IN CLOSED POSITION AND INSPECT ALL EXPOSED INTERNAL SURFACES OF DISCONNECT FOR DAMAGE AND CONTAMINATION	NO VISUAL DAMAGE
		INSPECT PD4 DISC INTERFACE METAL SEALING SURFACE. (REF R-2)	VISUALLY FREE OF NICKS, RADIAL SCRATCHES, GOUGES CRACKS AND CONTAMINATION
		MEASURE GAP BETWEEN POPPET GUIDE BUSHING AND SUPPORT WEB	0.010 INCH MAX VERIFY BUSHING IS POSITIVELY RETAINED
		VISUALLY INSPECT ACCESSIBLE SURFACES OF DOWNSTREAM SUPPORT WEB	VERIFY NO CRACKS USING VISUAL INSPECTION
V41BVO.020 V41BVO.020-B (GO2) V41BVO.020-E (GH2)	*JC 20009/20010*	**MPS ORB/ET DISCONNECT CLEANING** PD4 PRESS DISC CLEAN PD5 PRESS DISC CLEAN	Visually Clean Visual & Ultraviolet
V41BU0.330 V41BU0.330-A (GO2) V41BU0.330-B (GH2)	*JC 20009/20010*	**MPS COMPONENT CAVITY INSPECTION** INSPECT CAVITY AROUND 2" GO2/GH2 DISCONNECT INTERNAL AND EXTERNAL TO AFT FUSELAGE.	NO METALLIC PARTICLES ALLOWED. NO NON-METALLIC PARTICLES LARGE ENOUGH TO CHANGE THE MOVEMENT CHARACTERISTICS OF THE 2" DISC ALLOWED.
		INSPECT CAVITIES SHOWN BY FIGURE 1.0 OF ML0510-0023/ML0510-0022 INSIDE	NO VISIBLE CONTAMINATION ALLOWED.
V41BUO.190	*JC 20009/20010*	**PD4,5 ORB/ET PRESS DISC ALIGNMENT/FUNCT** VERIFY ALIGNMENT OF ET/ORB LH2 & LO2 UMBILICAL ASSY PRESSURIZATION DISCONNECTS.	
		ALIGNMENT VERIFICATION	DISCONNECT POPPET STEM CENTER TO BE WITHIN 1/32 INCH OF ALIGNMENT.
		OPEN AND CLOSE THE 2-INCH DISCONNECT POPPET MANUALLY BY DEPRESSING POPPET STEM.	NO BINDING WITH SMOOTH OPENING AND AND CLOSING MOTION.
		INTERNAL PRESSURE	AMBIENT
V41BU0.190-A (GO2) V41BU0.190-B (GH2)		PD4 PRESS DISC ALIGNMENT/FUNCTIONAL PD5 PRESS DISC ALIGNMENT/FUNCTIONAL	
V41GEN. 230	*JC 20009/20010*	Blanket pressure is required except for: LO2/LH2/GO2/GH2 systems- Rollout from OPF to VAB through Orbiter/ET Mate until Initial Orbiter Power Up	
Orbiter Inflight Checkout			
DV41AYO.200 (GO2) DV41AYO.210 (GH2)	Data Retrieval	Post-MECO pressure decay of the pressurization systems	15 scim plus the sum of the known leakages of components within the system

EXTERNAL TANK GO2 2 INCH DISCONNECT FAILURE ON ET-106

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OMRSD	WAD the OMRS is Implemented in	Requirement title/Description	Pass/Fail Criteria
ET Checkout (in C/O Cell)			
T41QAL.060 T41QAL.060-B T41QAL.060-C	T1102 and T1248	**Inspect ET/Orb mating surfaces** PD4 2" GO2 DISCONNECT PD5 2" GH2 DISCONNECT	Verfy mating surface free of nicks, gouges, scratches Verify mating surfaces and interior free of foreign material and visibly clean using white and ultraviolet (O2 only) light No raised metal allowed. Design Eng. assessment req'd for any condition beyond insp. allowable
T41QAL.085 T41QAL.085-A T41QAL.087-B	T1102	**2" GO2/GH2 Disconnect Inspection** Visually inspect accessible areas of disc, including: support web, bushing, cap screws, cap assy.	Verfy no nicks, gouges, scratches, or audible leakage Verify mating surfaces and interior free of foreign material and visibly clean using white and ultraviolet (O2 only) light No raised metal allowed. Design Eng. assessment req'd for any condition beyond insp. allowable
T00GEN.040 T00GEN.040-H (GO2) T00GEN.040-I (GH2)	T1102 and T1248	PHOTOGRAPHIC REQUIREMENTS PD4 2" DISCONNECT PD5 2" DISCONNECT	

EXTERNAL TANK GO2 2 INCH DISCONNECT FAILURE ON ET-106

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OMRSD	WAD the OMRS is Implemented in	Requirement title/Description	Pass/Fail Criteria	Additional Notes
ET/Orbiter Mate Operations (VAB)				
SOOHCO.400 SOOHCO.400-D (GO2) SOOHCO.400-E (GH2)	S0004	2-in Disc Mating /Alignment	Visually Verify pressurization Disc Poppet Stems are in alignment within 1/2 diameter. 2-in Disc Stem diameter is .310 inches	Poppet stems fully aligned
Orbiter/ET Interface Leak Checks (VAB)				
SOOOOO.080-C (GH2)	V1149	**PD5 2" I/F seal L/C 6 psi**	5.5-9.7 psig 30 scim max	2.56 scims at 7psig FLt 26 1.94 scims FLt 25 0.60 scims FLt 24 0.11 scims
SOOOOO.081-B (GO2)	V1149	**PD4 2" I/F seal L/C 6 psi**	5.5-9.7 psig 11 scim max	7.47 scims @ 7 psig FLt 26 2.72 scims FLt 25 2.36 scims FLt 24 2.10 scims
Helium Signature Test (Pad)				
SOOOOO.081-C SOOOOO.080-D	V1202	PD4 2" GO2 I/F seal L/C 400 psi PD5 2" GH2 I/F seal L/C 400 psi	185 scim max 185 scim max	